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SHAVINGS EXAMINED MICROSCOPICALLY.

BY PROF. A. M. EDWARDS.

THE examination of any organic tissue, be it animal or vegetable, by means of the modern achromatic microscope, reveals such a world of beauty, and so much material for wonder, that the novice in such pastime is for a while very much puzzled what to observe, and what to leave unseen. Although life, that mysterious manifestation of Divine will, appears to be most strikingly made manifest in animal existences, yet the grass of the field and wood of the oak tree present materials attractive to him who will patiently read aright the lessons they inculcate. It is my intention, in the present article, to point out to the young student of nature a path that may be traversed with great profit and lasting pleasure. I have taken as my subject the structure of wood, the hard tissue of plants, as exhibited in the shaving which the carpenter peels off with his jack-plane. Let the embryo microscopist collect a number of such, the thinner the better, and I warrant he will have enough to do when looking at them through the long winter's evenings.

All plants, it has been discovered, great and small, the monarch of the woodland and the violet of the plain; aye, all, with the exception, perhaps, of those doubtful little

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organisms that puzzle and delight the students of atomies, and which are grouped under the great collective head of the *Protophyta*, are constructed after the same general plan, and consist of the same chemical substances, congregated together after similar types, varying only in degrees of complexity. And what is an equally, if not more remarkable fact, those substances which go to make up the bulk of the vegetable organism are found also in the animal, constituting the elementary components of its body likewise.

However it is not our intention, at the present time, to enter into the consideration of the chemical constitution of vegetable tissues; interesting as that branch of vegetable physiology is, we must forbear, and, assisted by the microscope, proceed to the examination of those tissues themselves. The general structure of all plants consists of a substance known to chemists under the name of cellulose, the wall-matter of cells, so to speak; cells being the most important part of plants, as we shall see presently. It is this cellulose that we are so well acquainted with under so many different forms and names and constituting vegetable fibre, bark, the great mass and harder portions of all leaves, flowers, fruit and stems; and, although in special cases we find it somewhat modified, it is always to be recognized from its possessing certain unmistakable characteristics, familiar to all in the substance of paper, and, therefore, of course, in the linen or cotton, the wood or the straw from which the paper was made, so that we say that about all the paper we see is composed of cellulose in almost a pure condition, there being but little used which is manufactured from animal tissues, such as wool and silk. The rice-paper of the Chinese is not, as is generally supposed, made of rice, but of the light and porous pith of a plant which has been cut in the form of a broad strip, around and around the mass of the tissue, as is plainly seen when a small piece is examined by means of a magnifying glass, when the little cells or cavities which made up the pith are very evident. Woody

tissue is made up for the most part of this cellulose, arranged in different forms, all, however, derivable from the simple sac or cell, which is the basis and foundation, morphologically, of the whole vegetable kingdom; being found in its simple and uncomplicated form in the *Protophyta*, or first plants, we have mentioned, and modified in outline to a greater or less degree in the different parts of the tree, stem, leaves, and flowers. There is a doubt, however, in the minds of some physiologists as to whether the hard parts of plants are made up of this substance cellulose, or a modification of it termed "lignine." This point is one which we will not consider, as it is extremely doubtful if either of these two compounds has been obtained pure and separate from the other.

If a slice be made with a very sharp knife of some ripe fruit, as an apple or an orange, it will be observed on viewing such a section by means of the microscope, that it is made up of almost symmetrical and equal sized little sacs or cells, as they are called; and such simple tissue is known as cellular tissue. But if a similar slice be made of such hard matter as wood, a very different appearance will present itself to our eyes. First, however, so as to make ourselves acquainted with the manner in which such simple cellular tissue (where the elementary sacs merely touch each other with very little mutual pressure) passes into the more complex woody tissue, take a similar slice from the stem or young rootlet of some herbaceous plant, as the garden rhubarb or other common vegetable. Such a slice, made as thin as possible, is now placed in a little water upon a glass "slide," and, with a thin "cover" over it, examined by means of a microscope which does not magnify too strongly. We now see that the tissue in this case is cellular, as well as that in the fruit, but that the individual cells have become much altered in appearance from mutual pressure, which in some cases has been equal upon all sides, in others greater in certain directions than in others. So they have been crowded

upon each other until they have lost their almost spherical outline, and flat sides have made their appearance. We may illustrate the form of vegetable cells by blowing soap-bubbles with a tube. As long as we blow but one bubble at a time, they remain spherical in form and represent the simple *Protophyta*, but if we blow one after another until a string of them remain pendant from the tube we have a representative of the slightly more complex plants growing submerged in water and known as algæ. By placing the tube beneath the surface of the soapy liquid contained in a bowl and blowing we form a number of bubbles, which, on account of their being confined within the bowl, press upon each other almost equally and become many sided. The form that thus results is found on examination to be of a more or less perfectly geometrical outline, and such a mass very strikingly represents the cellular tissue we are examining, but to make it look still more like our section, we press a glass plate down upon the mass of bubbles, and thus we have the cavities cut across. But one other fact will be noticed through the glass plate, and that is that the bubble sections are for the most part six-sided, and such is also the case with the plant cells. This is the result of cutting through the regular geometrical form always caused by the mutual equal pressure of many spheres. In honeycomb we have another illustration of this fact; there the pressure has apparently been unequal, and the cell has become elongated into a six-sided prism. A precisely similar mode of aggregation is to be observed in vegetable tissues, and may be made evident by cutting two sections at right angles to each other. Such slices are known to microscopists as longitudinal and transverse sections; the first, in the case of wood, being taken lengthwise of the stem or branch, and the other across it. As the pressure is generally very unequal, perfect forms of the cells are the exception, and therefore the variety of outline of cells in vegetable tissues is very varied, that which is hexagonal being the most common. As a plant

grows, the number of cells is multiplied, and as the growth is faster in one direction than in others the resulting cells are elongated; in fact we find in woody tissues that the so-called wood cells are more or less fibrous, so that such tissue is known as woody fibre. These wood-cells are pointed at both ends, in fact are fusiform. Some of the cells, however, become united by the absorption of their contiguous walls, so that continuous tubes are formed. These tubes are for the purpose of transporting the life-blood of the plant (the sap), which like the blood of the animal, is the source of the new tissues which are built up from its matter. As these tubes are of such importance in the economy of the individual, it becomes necessary that they should be protected from injury, and such injury is most likely to be a crushing from without and a consequent stoppage of the flow of the sap. If we were to stop the flow of the blood in the arm, for instance, by tying a ligature above the elbow, we should find that disorganization of the tissues in the fore-arm and hand would result; they would mortify and death of the parts would follow. The same thing we can readily understand would take place in the plant, should the sap-flow be arrested in any way. To prevent such a disaster these long tubes are strengthened in a very remarkable manner, namely, by having a deposit of tough lignine formed within their walls, and arranged in the form of a spiral. The same mode of structure is to be seen in the tubes called tracheæ, which convey the air to and from the lungs of animals. Insects exhibit this structure in a very striking manner; the tracheæ of a caterpillar of some kind, most commonly the silk-worm, is a favorite microscopic object. The spiral arrangement at the same time permits of a certain amount of elasticity in such vessels, as is to be seen in a very common illustration of such structure. I allude to the flexible tubing used to convey burning gas from a chandelier to a burner upon the table. Such spiral ducts, as they have been named, are to be seen in most cross

sections of wood, and in our plate are represented by the largest openings. In some of the succulent plants, however, they are to be seen in a more striking manner. It is only necessary to tear a stalk of rhubarb or celery apart to find that fine fibres appear which are the last things to be ruptured; these are the spiral ducts, and constitute the "stringiness" of old specimens of vegetables. In our wood shavings we also observe other points of interest, more especially if the sections be cut across the "grain" or direction of the main growth. First let us examine the upper of our figures (Pl. 10, fig. 1), which represents such a slice cut from a stick of oak. This has been taken from a common kind of wood and well representing the grand group of plants to which it belongs, that is to say the *Exogens*, or outside growers. Our lower figure, on the other hand, represents a section of a stem of sugar-cane, showing the mode of growth of an *Endogen*, or inside grower. And these two names at once designate the point upon which we wish to dwell; the mode of growth of woody stems as shown by means of the microscope. These figures have been carefully drawn from photographs taken for the purpose, and are, therefore correct representations of the objects. Looking now at our cross-grain shaving of oak, we notice first, scattered somewhat unevenly all over it, large openings, which are the spiral ducts; in some parts they appear to be more closely congregated together, forming, as it were, rows which are continuous after the manner of rings, increasing in dimensions from the centre of the stick towards the circumference. These show us how the wood grows. At first, when it is but a sapling, there is very little woody tissue present, as is evidenced from its fragility, and the moss of it is made up of simple cellular tissue. This constitutes the pith of the stem, and varies in dimensions in different plants; in the elder being very large, in the oak of small size. Through the large spiral ducts the sap freighted with matter for the building up of new tissues, is carried upwards to the leaves;

here it is brought in contact with the sunlight and air, and certain chemical changes take place in its composition. Downwards, through another set of ducts, it is carried just inside the bark, and here through its instrumentality, woody fibre is deposited, one fibre upon the other externally, and thus the twig grows by outside growth, becoming thicker and thicker each year. This addition of substance goes on during the spring and autumn months, the plant doing very much the same as human beings, that is to say, resting during the hot season. But when winter comes its growth is arrested entirely, and like the hibernating animals the tree sleeps. Now in animals the blood is carried by a set of vessels, known as arteries, to the lungs, where it comes in contact with the air inhaled, and has its composition so changed that it can build up new tissues. The same thing, essentially, we see, takes place in the tree, the leaves representing the lungs, or oxygenating organs. Now as the tree sleeps during the winter months here is an arrest of growth, and therefore when we examine such a cross-section of a piece of wood as we have given, we find a number—less or greater, according to the number of winters it has existed—of these rings of arrested growth, and by counting them we can arrive at the age of such a stick of wood. So we see how the microscope assists in acquiring such a knowledge; and of course we shall find similar structure in all outside growers or *Exogens*. With inside growers the case is very different; for here the new matter is not deposited externally in regular rings; and, in fact we can, from a consideration of the facts we have related, readily understand why the *Endogens* are mostly confined to such portions of the globe where there are no cold months to arrest the growth. However, even in such climates, *Exogens* grow and rest also during a part of the year. We have given the two sections represented to show the very marked difference in these two modes of growth as illustrated by microscopic sections, and those who desire to verify our illustrations can readily do so

by cutting a slice of some green stem, when the sap is in the wood and it is therefore the more readily cut, and also taking a slice of some *Endogen*, the garden asparagus being an excellent plant for that purpose, and after placing them on a glass "slide" and moistening them with water, covering them with a piece of thin "covering glass," and then examining them with a microscope; even an ordinary pocket lens will often show these points of structure very well. Thus will the student of nature find instruction and amusement, knowledge and pastime, even in a shaving of wood cast off from a carpenter's jack-plane.

EXPLANATION OF PLATE 10.

Fig. 1. Section of oak wood cut transversely across the grain.
Fig. 2. Transverse section of sugar cane.
Both magnified 25 diameters.

NOTES ON SOME OF THE RARER BIRDS OF MASSACHUSETTS.

BY J. A. ALLEN.

(Continued from page 519.)

GOLDEN EAGLE. *Aquila chrysaëtos* Linn. (*A. Canadensis* auct.) A specimen was killed near Munson in November, 1864, and another near Deerfield, December 14th, 1865. The latter, a female, is said to have weighed thirteen and a half pounds, and to have measured seven feet and six inches in alar extent. It is now in the Springfield Museum of Natural History. Mr. J. G. Scott informs me that two specimens were captured near Westfield three years ago, one of which is in his cabinet.*

* In epist., Nov. 21, 1868.

Fig. 1.

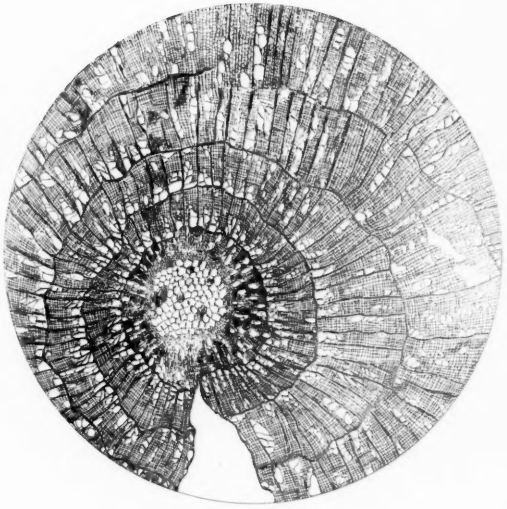
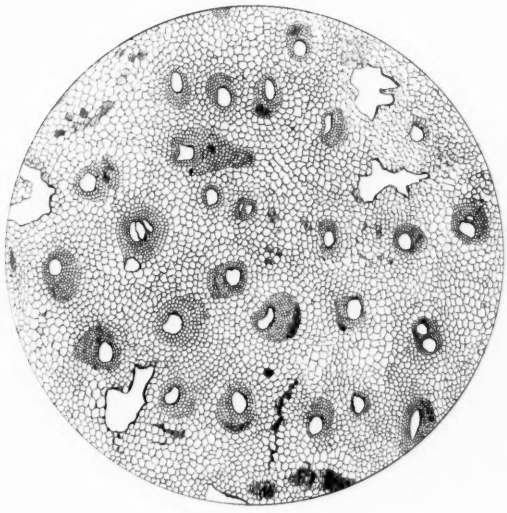


Fig. 2



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Osprey. Fish Hawk. *Pandion haliaëtus* Sav.* (*P. Carolinensis* Bonap.) It seems at first a little strange that this noble bird should not be found breeding anywhere on the Massachusetts coast, but when we recall the peculiar situations usually chosen by it for its eyrie we cease to be surprised. At present there are here no heavy forests near the sea, with lofty dead trees spreading their broad whitened arms to receive its bulky and conspicuous nest. All who are acquainted with this bird's breeding habits must have been struck with its marked predilection for such nesting sites. While it breeds abundantly on the New Jersey coast, on portions of Long Island, on the coast of Maine and about the large lakes in the interior, it is now only seen in this state, so far as I can learn, during its migrations. It undoubtedly nested here before the thorough disforesting of the seacoast; a former nesting site near Ipswich being still remembered by some of the older residents there. The present puny second forest-growth affords it no suitable breeding places, and this is no doubt the reason of its being now but a transient visitor here.

Hawk Owl. *Surnia ulula* Bon. Mr. A. L. Babcock of Sherborn, has a specimen which he took a few years since at Natick. Dr. Brewer informs me he once obtained it near Roxbury. Mr. Scott writes that five specimens were taken at Westfield, near the village, in the autumn of 1867. In my Catalogue this species, though mentioned incidentally as probably occurring occasionally along the Green Mountain ranges in the western part of the state, was not reckoned as a Massachusetts bird. Dr. Emmons says it has been observed in that section in autumn,† and from what I now know of its distribution I doubt not it is a somewhat regular winter visitor there.

*In the Museum of Comparative Zoölogy are numerous specimens of this bird, from Brazil, Florida, and New England, the North, and from Europe. They differ a good deal, but some of those that differ most are from the same locality. I cannot see wherein the European differ essentially from the American. Some of these are more like the American than some of the American are like each other.

† Hitchcock's Geological Report for 1835.

Great Gray Owl. *Syrnium cinereum* Bon. I mentioned the capture of several specimens in this state in my Catalogue. Dr. Brewer has since informed me that about 1839 he obtained two for Mr. Audubon that were shot near Boston,—a fact which does not appear to have been previously recorded. There is also a specimen in the Museum of the Peabody Academy, taken in Salem, November 10th, 1866, by Mr. E. S. Waters.

Great Horned Owl. *Bubo Virginianus* Bon. There are three specimens of this species in the Museum of Comparative Zoölogy, all from Eastern Massachusetts, that represent Mr. Cassin's three varieties *Bubo Virginianus Atlanticus*, *B. Virginianus Pacificus*, and *B. Virginianus Magellanicus*. The first of these he supposed to be restricted to the Atlantic slope of North America, the second to the Pacific slope, and the third to the extreme southern parts of this continent and to South America. Mr. Cassin remarks, "this fine species is either subject to considerable variation in the color of its plumage, or there are several species, some of which have been named by naturalists, as cited above, in our synonymes."* The first of these alternatives it seems to me is the true state of the case.

Barn Owl. *Strix pratincola* Bon. As already stated by me in the "Addenda" to Dr. Coues' "List of the Birds of New England," the first specimen of this species known to have been captured in this state was taken near Springfield, in May, 1868. Dr. Wood informs me that he has a specimen in his cabinet that was shot "at Sachem's Head [Ct.,], October 28th, 1865." The capture of another at Stratford, Connecticut, is recorded by Mr. Linsley.† These three are all thus far known to me to have been taken in New England.

Yellow-billed Cuckoo. *Coccygus Americanus* Bon. No other of our birds seems to be so variable in numbers in

* Report on N. American Birds, p. 50.

† See "Catalogue of the Birds of Connecticut," by Rev. J. H. Linsley, Am. Journ. Science and Arts, Vol. xliv (1843), p. 253.

different years as this. In my Catalogue it is mentioned as "extremely rare" at Springfield, but as occurring frequently in the eastern part of the state. Since then a number of specimens have been taken at Springfield, and others at Westfield, Chicopee and Holyoke. Dr. Wood says that it "has been very uncommon at East Windsor Hill, except in 1867, when it was as common as the Black-billed. I obtained," he adds, "three sets of eggs during that season; have seen none this year."* I think it was in 1867 that it was so unusually common at the other above-mentioned localities, but it was also taken at Springfield in 1866. Mr. Scott says he does not think it "extremely rare," as he has obtained four or five specimens without special effort. In the eastern part of the state I find it is not generally so numerous as I had supposed. It seems to be common here only at irregular intervals, when it sometimes appears to be as numerous as the Black-billed species, but sometimes it is scarcely observed for several seasons. Mr. Maynard says it was common about Newton during 1866, when the Black-billed was rare, but that it has not been so since that year, while the latter has been abundant. If the very large collections of birds from a considerable number of localities in New England in the Museum of Comparative Zoölogy can be taken as any index of their relative abundance in the Eastern States, the Black-billed species may be considered as, on the average, a hundred fold more numerous than the other.

Yellow-bellied Woodpecker. *Sphyrapicus varius* Baird. As observed by Dr. Coues,† this bird may be common in summer at many localities in New England. But in this state, so far as I can learn, it is rare at all seasons in that portion east of the Connecticut, and generally seen only in the fall. Not so, however, to the westward and northward; but I doubt its being any more numerous in Rhode

* In epist., Oct. 22, 1868.

† In List of the Birds of New England, l. c., p. 262.

Island and Eastern Connecticut than it is in Eastern Massachusetts.

Pileated Woodpecker. "Log Cock." *Hylotomus pileatus* Baird. The capture here of a bird so nearly extirpated in most parts of Massachusetts as is this, is a fact of interest. Mr. J. G. Scott informs me that he has taken three specimens near Westfield. Dr. Wood wrote me in 1864 that one was killed about five years before at East Windsor Hill, and that he had also seen it about twenty miles to the westward of this locality.

Black-backed Three-toed Woodpecker. *Picoides arcticus* Gray. Mr. Scott took two specimens, male and female, of this northern species at Westfield in 1867.

Banded Three-toed Woodpecker. *Picoides hirsutus* Gray. I learn from Mr. George O. Welch, of Lynn, that he took a pair of these birds some years since not far from that town. Dr. Brewer also gave it in his additions to the "Catalogue of the birds of the state" given by Dr. Hitchcock,* but it has not usually been numbered among the birds of the state, and doubtless occurs only as an accidental winter visitor.

Yellow-bellied Flycatcher. *Empidonax flaviventris* Baird. As remarked by Dr. Coues in his "List of the Birds of New England," this species is probably less rare than the collectors usually suppose. It seems to prefer woods and thickets, and its close resemblance to *E. minimus* when a few yards distant tends to prevent its more frequent capture. I generally meet with quite a number each year in May, sometimes several in a single excursion. Mr. Maynard informs me that he took eight specimens in a few hours May 31st, the present year. It has been observed in the breeding season as far south as Washington, D. C., by Dr. Coues.

Varied Thrush. *Turdus nævius* Gmelin. As already recorded in Dr. Coues "Addenda," this western species has at last been taken in Massachusetts, a specimen having been

* Jour. Bost. Soc. Nat. Hist., Vol. i, p. 437.

shot near Boston (at Ipswich) in December, 1864. This seems to be the first known instance, as the specimen mentioned by Prof. Baird as having been obtained here was killed in New Jersey.*

Robin. *Turdus migratorius* Linn. Generally this well known bird is not met with in Massachusetts in winter except at particular localities; it seems more frequently to occur at this season in the eastern part of the state than elsewhere. It is not seen every winter, but sometimes occurs in considerable abundance. In the severe winter of 1867–'68, they were seen in Cambridge at intervals all winter; they were more numerous in January than in December, and were still more abundant in February, when they appeared in quite large flocks. They disappeared on the approach of warm weather, leaving for the north or for the interior before the arrival of their brothers from the south, which this year first appeared about March 10th. It does not seem to be an unusual mildness of the season that causes them to linger, as they are as often seen during the severer winters as in the milder.

Hermit Thrush. *Turdus Pallasi* Cab. Although the southern limit of this species in the breeding season is nearly coincident with the southern boundary of the Canadian fauna,† straggling pairs breed in various parts of Massachusetts. It has been taken at Springfield in June,‡ and last year I saw young just able to fly at Hyannis, July 3d. Dr. Brewer informs me he found it breeding in Roxbury, in 1837. In the more elevated western districts of the state, as in the elevated and northern parts of New England generally, it breeds regularly and in large numbers.

Olive-backed Thrush. *Turdus Swainsonii* Cab. As is well known, this is not a rare species in this state.

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*See my "Catalogue," l. c., p. 82.

†In respect to the boundaries of the Canadian and Alleghanian Faunæ, see Prof. Verrill's remarks in the Proceedings of the Boston Society of Natural History (Vol. x, p. 250) and my own in the Memoirs of the Boston Society of Natural History, Vol. i, pt iv, p. 489.

‡See "Addenda" to my "Catalogue," l. c., p. 97.

In my "Catalogue of Massachusetts Birds" I first advanced the opinion that the so-called *Turdus "Aliciæ"* Baird, or Gray-cheeked Thrush, was but the paler form of this species. To this view other writers have taken exceptions. Prof. Baird, in his "Review of American Birds" (p. 21), summarily disposes of the matter by presuming that I had not seen what *he* called *T. Aliciæ*. Dr. Coues, in his "List of the Birds of New England," in referring to my remarks on the subject, says they "illustrate very fully the well-known seasonal and other variations to which *T. Swainsonii* and *T. fuscescens* are subject," and adds that I appear to have been "autoptically unacquainted" with *T. Aliciæ* at the time of writing them. Since that time I have still farther considered the subject, and have had large series of authentic specimens of both *T. Swainsonii* and *Aliciæ* (mostly so labelled at the Smithsonian Institution) for comparison with Massachusetts specimens, and after five years of additional experience I am now more than ever convinced that the opinion there expressed is correct. Some years the *Aliciæ* type is quite common; again more rare. Generally, however, the majority of the specimens range between the forms considered as typical respectively of *T. Swainsonii* and *T. Aliciæ*.*

Mocking Bird. *Mimus polyglottus* Boie. Several instances of the occurrence of this southern species in the vicinity of Springfield other than those previously recorded have come to my knowledge during the last five years, and also one of its occurrence in the eastern part of the state.

Connecticut Warbler. *Oporornis agilis* Baird. Concerning this species Mr. C. J. Maynard writes: "Perhaps not as rare as is generally supposed by collectors, especially in autumn. A specimen was shot by Mr. L. L. Thaxter in Newton Centre, September 16th, 1867. Another was taken by myself in September, 1868, in a thick swamp near Newton."†

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*For a fuller discussion of this subject, see my paper in the Memoirs of the Boston Society of Natural History, Vol. i, part iv (1868), p. 507.

†MSS. notes, received June, 1869.

TENNESSEE WARBLER. *Helminthophaga peregrina* Cab. This species, generally rare here, appears to have been much less so this year than usually. Mr. Maynard took five at Newtonville during May 18th to the 23d,—the first, he says, he had seen. He informs me that his friend Mr. William Brewster procured at about the same time two near Mount Auburn. I have taken it repeatedly at Springfield, where I have always esteemed it rare; but Mr. Boardman says he finds it quite common near Calais, Maine.*

GOLDEN-WINGED WARBLER. *Helminthophaga chrysoptera* Baird. This beautiful warbler has been taken, so far as I can learn, but a few times in the western part of the state; it seems to be more common in the eastern, where it breeds. I saw it once in July at Springfield, and Mr. S. Jillson informed me some years since that it was quite frequent at Bolton, where it spends the summer and undoubtedly breeds. I am not aware that its nest has been found in the state prior to the present year, when it was discovered by Mr. C. J. Maynard, June 12th, near Newtonville. This gentleman says that for the last three years he has seen this Warbler in swampy thickets near Newton in June, and felt confident that it bred there. This year he observed a female so anxiously chirping from a small elm that he felt sure she had a nest in the vicinity, and quietly watching her he soon saw her fly down into the weeds. Approaching the spot carefully he discovered her sitting on her nest. This he describes as situated on the ground, in a tract of coarse weeds and ferns near a swampy thicket, and but a few rods from a public highway. It was placed entirely above the surface of the ground, and the birds seemed to have made no special effort to conceal it. It was composed externally of dried oak leaves and the bark of the grape-vine, and rather roughly lined with fine grass and a few horse hairs. He says it is large for the size of the bird, and somewhat reminds one

* See American Naturalist, Vol. iii, June, 1869, p. 122.

of the nest of the Maryland Yellow-throat. It is a little smaller at the top, where the internal diameter is less than two inches, while in the middle it is two and a quarter. The eggs were five in number, including a Cow Bunting's egg that these watchful parasites had introduced. The Warbler's eggs are thus described by Mr. Maynard:

"No. 1 is regular in form, thickly spotted and blotched with dark brown at the larger end and sparsely at the smaller, on a white ground. Length, sixty-six one-hundredths of an inch; diameter, fifty-five one-hundredths. No. 2 is like No. 1, only it is less thickly spotted. Length, sixty-six one hundredths; diameter, fifty-three. No. 3 is least spotted of the four, it being but sparsely so on the larger end and not at all on the smaller. Dimensions same as those of No. 1. No. 4 is more elongated, and much the most spotted, the spots forming a broad band around the larger end, and are scattered over the remaining surface."

Mr. Maynard adds: "It is a curious fact that although I have seen and collected quite a number of males of this species, this is the first female that I have seen, although I have made diligent search for them."

Swainson's Warbler. *Helmitherus Swainsonii* Bon. Although this species is recorded by both Audubon and Peabody as having been taken in Massachusetts, and on these authorities given in my Catalogue, there is some reason to doubt its having been captured here. Both notices doubtless refer to the same specimen, as well as to the same authority,—Dr. Brewer. But this gentleman informs me that the record is erroneous and the result of a misunderstanding; the specimen referred to he says was not this species at all. Dr. Brewer knows of no instance of its occurrence here, and it should doubtless be stricken from the list of Massachusetts birds. Dr. Coues says he has never seen it so far north as Washington, D. C.*

Worm-eating Warbler. *Helmitherus vermivorus* Bon. Mr. Peabody states, in his "Report on the Birds of Massachusetts," that the nest of this species had been found in Cambridge, which statement I repeated in my Catalogue.

*List of Birds of New England. Proc. Essex Inst., Vol, v, p. 270.

I have since been informed by Dr. Brewer that the nest referred to by Mr. Peabody as above "was, without doubt, a Nashville Warbler's. I do not think it occurs," he adds, "nearer than the Hudson River."* Prof. Verrill, however, in his list of the birds of Norway, Maine (p. 21), gives it as rare in the southern part of Maine. From its range being generally southern, its occurrence in New England can only be accidental.

SMALL-HEADED FLYCATCHER. *Wilsonia minuta* Bon. This rather apocryphal species is given by Peabody as having been met with at Ipswich by Dr. Brewer, and in Berkshire County by Dr. Emmons (Rep. Orn. Mass. p. 297). Dr. Brewer writes me that in 1834 his cat caught a specimen of this species in Roxbury, which he sent to Audubon, though as Dr. Brewer observes, he (Audubon) makes no mention of it. Dr. Brewer remarks: "This was the only one I ever knew or heard of. Ipswich I *ignore*." Compare with this Dr. Coues' remarks on this supposed species in his "List of the Birds of New England."†

LONG-BILLED WATER THRUSH. *Seiurus Ludovicianus* Bon. The first and only specimen thus far known to have been found in Massachusetts I captured April 28th, the present year, on Mount Tom. There is another in the Museum of Comparative Zoölogy, taken by Irving Frost, at Norway, Maine, in May, 1865. These two I believe are all the specimens known from New England, its actual occurrence in the Eastern States being now for the first time reported.‡

BLACKBURNIAN WARBLER. *Dendrœca Blackburniæ* Baird. Mr. Bennett found the young of this species this year near Holyoke that were scarcely able to fly. This establishes its breeding in Massachusetts. This fact I had already inferred, as in 1863 I shot it in Springfield, June 24th. Mr. J. G. Scott also shot it in Westfield, late in June, 1866. Some

*In epist., May 8, 1869.
†Proc. Essex Inst., Vol. v, p. 275.
‡See concerning this species Dr. Coues' List of New England Birds, l. c. p. 271.

seasons they are extremely abundant at some localities, and commonly are not rare, except in particular situations. Mr. Scott observes that for several weeks in May, in 1866, he could remain at a single place in the woods and shoot ten to twenty per hour.

Bay-breasted Warbler. *Dendrœca castanea* Baird. This species I find is esteemed to be rare by most collectors in the eastern part of the state, but in the Connecticut valley it is generally more or less common and sometimes very abundant. I found it very numerous in 1866 in Springfield, and it seems to have been equally so the same year in Westfield. Mr. Scott writes, "I could easily have shot a bushel-basket full of them without very greatly changing my position." He says it was scarce in 1867, but not very rare in 1868. In 1866 he obtained a partial albino. Mr. Maynard, however, considers it to be very rare about Newtonville. He has known only a few specimens taken there, as follows: June 19th, 1867, May 22d, 1868, and May 27th, 1869.

Prairie Warbler. *Dendrœca discolor* Baird. In particular situations a more or less common summer resident. In the eastern part of the state, especially in the breeding season, it is much more common than in the western. Old pastures partially grown up to cedars and barberry bushes seem to form its favorite resorts.

Cape May Warbler. *Perissoglossa tigrina* Baird. This species, like most of the warblers, varies greatly in abundance in different years and at different places. Generally it seems to be very properly regarded as rather rare. Specimens, however, are taken almost every year in different parts of the state, but generally they altogether number very few. Mr. Maynard tells me it has been found near Boston, by Dr. Bryant and others, to be some years quite common.

Summer Red Bird. *Pyranga æstiva* Vieill. Mr. A. L. Babcock, of Sherborn, has a specimen taken in Framingham

some years since in May. This, I believe, forms the second authentic instance of its capture in this state. Two were taken in Lynn, April 21st, 1852, by Mr. S. Jillson.*

Northern Wax-wing. *Ampelis garrulus* Linn. The visits of this beautiful northern species so far south are very infrequent, and in only a few instances has it been recorded from this state. It has been taken, however, in Connecticut by Dr. Wood. I am also informed by Mr. S. Jillson, that eleven specimens were taken by him in Bolton, in this state, in January, 1864. A specimen has been seen the present autumn (October, 1869), in Cambridge, by Wm. Brewster.

Solitary Vireo. *Lanivireo solitarius* Bon. This species formerly supposed to be more properly a spring and autumn visitant than a summer resident, seems to breed not unfrequently at some localities. Dr. Brewer says it is as common in summer about Roxbury as any of the Vireos, except perhaps the Red-eyed.

White-eyed Vireo. *Vireo Novæboracensis* Bon. As stated in my Catalogue, this species is much more common in the eastern part of the state than in the western. Like some other species, it is much more common during some years than in others. Dr. Wood has found three nests at East Windsor Hill during the last ten years, but he considers it rare there. Mr. C. W. Bennett obtained the first specimen I have known found in Western Massachusetts in May, 1867, at Holyoke. I killed a pair the last week in July in Springfield, in 1868. These I believe are the only ones as yet known from that portion of the state. In 1868 it was quite common in and about Cambridge, but this year I have not observed it.

Loggerhead Shrike. *Collurio Ludovicianus* Baird. (*Lanius excubitoroides* and *L. elegans* Swain). This species, as observed by Dr. Coues,† was formerly given as a bird of New England, but deeming the authority to be highly ques-

*F. W. Putnam, Proc. Essex Inst., Vol. I, p. 224.
†List of the Birds of New England, l c. p. 277.

tionable, I omitted it from my Catalogue. As Dr. Coues remarks, New England is beyond its usual range; the nearest point heretofore given where it regularly occurs is Hamilton, C. W., where, according to Mr. Charles McIlwraith, it is not a very rare summer resident.* Mr. Charles Linclen informs me that he has this year obtained the birds and a nest containing six eggs at Buffalo, N. Y. Its occasional occurrence in New England hence becomes more probable.

On several occasions the so-called *Collurio excubitoroides* has been confounded by local observers with the *Collurio Ludovicianus*, and with very good reason, since they are undoubtedly the same. Specimens from the upper Mississippi valley, where the habitats of the two supposed species join, are with difficulty referred to the one rather than to the other. In habits and every particular, except in some minor differences of coloration, the two are quite alike. In fact no one seems to have insisted very strenuously on the specific distinctness of *C. Ludovicianus* and *C. excubitoroides* (or of *C. elegans* from the latter) though they have usually been presumed to be distinct. I have collected the birds in question in Western Iowa, Illinois, and in Florida; according to authors those from the first two localities should belong to *C. excubitoroides* and those from the latter to *C. Ludovicianus*. The differences between them are exceedingly slight. Specimens of the so-called *C. Ludovicianus* from the South Atlantic states differ from others from California and Iowa called *C. excubitoroides* not more than specimens of the latter from New Mexico do from Iowa ones, or than the two supposed species do in the average, and less than specimens from near the assumed line of junction of their respective habitats. Audubon, it seems to me, very properly regarded them as a single species. It seems to be rare in the Atlantic states north of Washington, but in the interior reaches the Saskatchewan valley, and extends westward to the Pacific, and south to Mexico. In avoiding the

* Birds of Hamilton, C. W., Proc. Essex Inst., Vol. v, p. 87.

North-eastern states it resembles the *Eremophila alpestris*, or Horned Lark (in the breeding season), *Myiarchus crinitus* (Great-crested Flycatcher), *Centurus Carolinus* (Red-bellied Woodpecker), *Melospiza Lincolnii* (Lincoln's Sparrow), *Zonotrichia leucophrys* (White-crowned Sparrow), and some other species that extend much farther north in the interior than on the Atlantic coast. The Horned Lark is not known to breed regularly on the coast much, if any, south of Labrador, but in the interior it breeds abundantly on the prairies as far south as Missouri, and even in Texas. Some of the other species mentioned above do not extend farther north on the coast than New Jersey, except as stragglers, although in the interior they reach the Saskatchewan. The climate there is certainly not warmer than that of Southern New England, and some other cause must be sought to explain such an unusual distribution.

Red-bellied Nuthatch. *Sitta Canadensis* Linn. The known instances of this bird's breeding in Massachusetts are very few. Five years since, when my Catalogue was published, I knew of none, and gave it as a winter visitant, having then seen it only during the colder portion of the year. Mr. Jillson has informed me that he found its nest a few years since in Bolton. Dr. Brewer also informs me that he saw it on his place in Hingham, in July, 1867, but was unable to find its nest. Many experienced collectors of birds in Southern New England have never met with it here in summer, but it is known to breed (perhaps only among the Alleghanies) much farther south.

Pine Grosbeak. *Pinicola eneucleator*. (*P. Canadensis* Cab.). This northern bird has occurred within the state several times within the last five years. During the last two winters they were quite common at certain localities, but were not generally distributed. As usual, they were chiefly young birds. It seems to be of late a more regular visitor than was formerly supposed.

Purple Finch. *Carpodacus purpureus* Gray. Common

in summer in many parts of the state, and the number that breed here seems to be increasing. They usually select evergreens for their nests, and appear to more often build in the cultivated shrubbery of the towns than elsewhere. They are almost as unsuspicious as the proverbially familiar Chipping Sparrow (*Spizella socialis*), they often placing their nests in the hedge-rows that border frequented walks. I learn from Mr. B. P. Mann that he has repeatedly found their nests in such situations, and Mr. R. B. Hildreth has observed the same fact at Springfield. This familiar habit in the Purple Finch of California has obtained for it the name of House Finch, and it was supposed to differ greatly in this respect from the Purple Finch of the Atlantic states, before the breeding habits of the latter were so well known. It differs in this respect not apparently from the eastern bird, nor in any other way to any essential degree, specimens from California in the Museum of Comparative Zoölogy being quite indistinguishable from others from Massachusetts. Hence its distinctive name of *frontalis* becomes properly a synonym of *purpureus*.

For the past two winters I have observed individuals of this species at frequent intervals in Cambridge, and Mr. Bennett has observed it at the same season about Mount Holyoke. By far the greater part, however, go farther south at this season.

Nearly all observers in Southern New England that I have met remark that this bird has greatly increased there during the last ten years; especially is it more numerous in the breeding season.

Pine Finch. *Chrysomitris pinus* Bon. But a single instance of the breeding of this bird in Massachusetts has come to my knowledge—that mentioned in my Catalogue. The present year, however, they were quite common in Cambridge till the last of June, and on two or three occasions I observed them during the first half of July. I felt sure at one time that they would breed here, but if they, like the

Yellow Bird (*Astragalinus tristis*), breed very late in the season, they may have retired in July farther north for this purpose, as I did not meet with them later in the season. This is very probably the fact, since Mr. William Brewster found this species breeding in August this year at Gorham, New Hampshire.

Red-poll Finch. *Ægiothus linaria* Cab. During the past five years this little northern visitor has been several times very numerous in Massachusetts. It was especially so during the winters of 1866–'67, 1867–'68, and quite so in 1868–'69.

A series of skins in the collection of the Museum of Comparative Zoölogy, collected in this state by Mr. C. J. Maynard, represent four of the so-called species of this group recently recognized,—the common *Æ. linaria*, the supposed larger Mealy Redpoll, *Æ. canescens* Aud.,=*Æ. epilipes* Coues, the *Æ. rostratus*, and the *Æ. fuscescens*, described as a new species by Dr. Coues.* From a careful examination of many specimens, from the far north, as well as from Massachusetts, I cannot consider these forms as distinct species, since the differences on which they are based are very inconstant, and connected by endless intermediate stages. The extreme forms to which these several specific designations have been applied are quite different from each other, and if the differences were constant might well be regarded as distinct species. But, as already stated, the differences are not constant, and it is almost impossible to draw a separating line between these several so-called species.†

Red Crossbill. *Curvirostra Americana* Wilson. This bird, as is well known, is very irregular in its visits to this state, not only in respect to numbers but in regard to the season of its appearance. It is generally most numerous in winter, but is sometimes more or less common throughout

* See his "Monograph of the Genus *Ægiothus*," Proc. Phil. Acad. Nat. Sci., Nov., 1865.

† On this point see farther my "Notes on the Birds of Iowa, Illinois, etc.," in the Memoirs of the Boston Society of Natural History, Vol. i, pt. iv, p. 515 (foot note).

the year; at other times very few are seen for a considerable period. Concerning this species I have received from Mr. Maynard the following very interesting note. He says that in 1868 these birds appeared in Massachusetts "early in September, in very immature plumage, which seemed to indicate," he thought, "that they were raised in the states. But upon visiting Oxford county, Maine," he continues, "October 12th, and not seeing a single specimen of this bird (although after the 21st the White-winged species was common) I was induced to inquire of the farmers respecting them, when I was informed that they passed through that region early in August, in large numbers, doing great damage to the oat crop. This shows that the unusual occurrence of this bird in immature plumage early in the season was owing to the early migration of northern raised birds, induced, probably, by an insufficient supply of food, which I think regulates the migrations of *all* northern birds; hence the irregularity of their visits. The species in question passed entirely south of Newton (Mass.), as upon my return from Maine, November 13th, not a specimen could be found, but *C. leucoptera* was abundant. From what I have seen of these two species I think the latter is generally much more boreal in its habits."*

Specimens of the Red Crossbill have been received at the Museum of Comparative Zoölogy from Massachusetts so young that it seems highly probable that they were raised here. Among them are specimens collected in Weston, in May, 1862, by the late Mr. Horace Mann. Some were so young that their bills were not fully grown, while the plumage also indicated great immaturity. It is hardly possible that they could have been born far from where they were collected. The condition of the specimens collected by Mr. Maynard, alluded to above, seems to indicate that they also have not been long from the nest, though they may, as he supposes, have come from Maine. These facts seem to

* MSS. Notes, received in July, 1869.

indicate that this species breeds at irregular times, since the eggs obtained near Milltown, Maine, by Mr. G. A. Boardman,* were, as he has informed me, found in February, and birds hatched thus early would probably moult their nesting plumage early in summer. Mr. Maynard's specimens must have been hatched at least as late as June, and probably in July, else in respect to the time of moulting the first or nestling plumage of this species is strangely anomalous. †

Since the above was put in type I have received from Mr. Boardman farther information respecting the breeding of the Crossbills, as follows: "They breed all the season, from the middle of February till into May, and perhaps later."

WHITE-WINGED CROSSBILL. *Curvirostra leucoptera* Wilson. This species is much less frequent in its visits than the preceding, it being, as Mr. Maynard has observed, much more boreal, and is generally seen only in winter. Last winter they were quite numerous in the eastern part of the state, when, as he has stated above, Mr. Maynard observed them as early as the middle of November. They remained, according to the same authority, till the first of June, they being observed by him in flocks during the last week of May. He also informs me that he shot a male in fine breeding plumage the 13th of June. In the summer of 1866 he found their stomachs filled with canker worms.

LAPLAND LONGSPUR. *Centrophanes Lapponicus* Kaup. This is a very rare winter visitor in the interior of the state, but rather common, according to Mr. Maynard, at Ipswich, where he has taken half a dozen in a day, and seen many more. It associates with the Snow Bunting (*Plectrophanes nivalis*), and is probably more or less common in winter along the whole coast of the state.

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*See American Naturalist, Vol. iii, July, 1869.

†With the above Mr. Boardman sends the following interesting notes: "The Canada Jay also breeds when the snow is quite deep, usually in March, and I think again in summer, as I have seen young birds in September. I have also found Raven's eggs when the snow was quite deep, and have also known the young of *Mergus Americanus* to be out by the middle of May, which is usually early."

THE LINGERING ADMIRERS OF PHRENOLOGY.

BY PROF. CLELAND.

To slay those that are already slain may be excellent sport to employ the courage of a Falstaff, but the reader perusing the title of this article may perhaps be disposed to ask why the pages of this review should be occupied with the discussion of so dead a doctrine as Phrenology. The answer is, that although phrenology never had much countenance from scientific men, and has long since been banished by them, with one consent, to the limbo of exploded chimeras, yet among educated men and women not physiologists, and not pretending to know anything about anatomy, it still holds its grounds wonderfully, and counts considerable numbers of people who believe in its miraculous skull maps; while, besides these, there is a far more numerous class of persons, including, undeniably, a certain proportion of scientific men, who, admitting that the minute division of the cranial vault into organs is untenable, yet profess belief in a larger mapping, and have no hesitation in relegating the reasoning faculties exclusively to the forehead, and the moral sentiments and volitionary powers to other parts of the brain-pan.

This state of matter does not exist without a sufficient reason to account for it. Long before the time of Gall and Spurzheim, men were in the habit, sometimes consciously, and much more frequently half unconsciously, of gauging the intelligence and moral qualities of their neighbors by their personal appearance generally, and more particularly of estimating them according to crude impressions derived from the shapes of their heads. They judged rightly enough that there was some connection between brain and mind. Much of the evidence that the brain is the organ of the mind is so palpable that it could not remain long hid. The effects

of injuries and diseases of the brain in disturbing the intelligence, its larger size in the higher than in the lower classes of animals, and more especially its distinctively great development in man: these circumstances, together with the indubitable frequency of finely proportioned heads among persons of distinguished talent, and the tendency of the eye to dwell on clumsy or forbidding proportions, when occurring in persons brought under notice as stupid and depraved, all seemed, though vaguely, to point out that a scrutiny of the amount of the brain and shape of the cranium was likely to afford an index of the strength and qualities of the mind. Gall propounded his theory that different portions of the brain were the organs of different mental faculties, and that according to the size of those different parts of the brain, so the mental qualities varied; and making continual observations on the heads and characters of those with whom he came in contact, he covered the surface of the cranial vault with a map, which at once professed to indicate the correct analysis of the mental faculties, and to assign to each of these its proper habitation. The psychological difficulties of their pursuit do not seem to have weighed heavily on either Gall or his followers; and as for the exceedingly great obstacles in the way of estimating the proportions of even large masses of the brain by observation of the surface of the skull, not only did the phrenologists strangely ignore them, but we are constrained to say that even anatomists have been very slow to appreciate them. Phrenology, however, supplied a want which the public felt, seeming to furnish an answer to questions which were continually obtruded before them, and giving precision to the notions founded on fact which had previously possessed their minds: this, we believe, is the principal reason why phrenology became so popular as it did, and why it is not yet eradicated from the public mind.

Probably scientific men, in dealing with phrenology, have been too much in the habit of contenting themselves with

merely pointing out that the system is certainly a blunder; and their hearers have gone away impressed with the conviction that it is impossible for the uninitiated to argue with experts, yet saying in their hearts that they are sure there is a mistake somewhere, and unwilling to part with all their beautiful theories and get nothing in exchange. Iconoclasm is not popular: when an image is thrown down it is well that its destruction should make way for a flood of light sufficient to satisfy the eye in its stead. This is an achievement not easy to accomplish, but actuated with the laudable motive of attempting it, the writer will try, not only to reiterate the reasons why phrenology cannot possibly be true, but to give some idea of what is positively known regarding the brain and its functions, and to point out in what direction speculation may be still legitimately indulged.

Let us begin at the beginning and try and form some general notion of what the brain is as it is known to the anatomist, before we dogmatize about the functions of the parts which happen to come in contact with the upper and lateral walls of the skull.

If a chick be examined in a hen's egg which has been allowed to hatch for twelve hours, or if the embryo of any vertebrate animal be examined at a similarly early period, it will be seen to exhibit a long open furrow, the walls of which are the first portions of the animal to be formed. The most superficial layer of substance entering into the construction of this furrow may be described as a long ribbon, consisting of two symmetrical parts separated by a longitudinal groove: this is the embryo brain and spinal chord, constituting one continuous structure, the cerebrospinal axis. The parts which support the ribbon form in like manner the cranium and the spinal canal, primarily undistinguishable one from the other. The edges of the furrow rise up and become united, so that the open furrow is converted into a closed cylinder; and similarly the ribbon within it has its lateral edges brought together, so that the brain and spinal cord

at an early period of their development, form one continuous tube. The walls of the tube so formed become ultimately much thickened and exhibit two kinds of texture, which, from their color, are distinguished as the gray and the white. In the case of so much of the tube as lies in the spinal canal and is afterwards termed spinal cord, the development proceeds very regularly; white matter is deposited on the outer wall of the cylinder, and gray matter on the inner wall, until it appears solid. A minute canal, however, the central canal of the spinal cord, continues to traverse its whole extent throughout life, and is the remains of the original hollow of the tube. Towards the lower part of the cord in birds there is even a space called the sinus rhomboidalis, where the cylinder is never completed, and the central canal is open on the dorsal aspect. Now, however different the brain may be in the adult condition from the spinal cord, it is extremely interesting to note that it is the anterior portion of the same cylinder, but that the cylinder undergoes some bendings, its walls are greatly thickened in some places and imperfect in others, and the continuation of the central canal is in some places greatly dilated, and in others contracted.

As respects texture, there is much in common between the brain and spinal cord. They are similar in appearance, and both consist of true nerve tissues, with a fine reticulum of supporting substance in which those more important elements are embedded.. The proper nerve tissues are two in number, nerve fibres and nerve corpuscles: the nerve fibres are long threads which have the property of transmitting along their course a certain change of condition which constitutes nervous influence, and which, it may be mentioned, is a purely physical action, not electrical, but involving in its operation electrical changes. Nerve fibres transmit this influence, but have no power of originating, directing, or modifying it: they are simply conductors, and such nerve fibres are the essential elements in all the nerves throughout

the body. Nerve corpuscles are bodies of which it is only necessary to say that they present a variable number of poles or branches, and there is no reasonable doubt that these poles are in direct continuity with nerve fibres. According to circumstances little understood, these corpuscles have the property of modifying impressions or nervous influence, and of directing them into different channels with which their poles communicate. Now the white substance of the brain and spinal cord contains only nerve fibres without any nerve corpuscles, these latter being found exclusively in the gray substance. It is quite plain, therefore, and universally recognized, that the white substance is only useful as containing channels of communication between different parts of the gray, and also between the gray substance and the muscles and sensitive parts throughout the body. But even the gray substance is not always or even generally capable of being affected directly by the consciousness; and in the case of the spinal cord, it is very certain that consciousness resides in no part of it, either white or gray. The spinal cord is the centre with which are connected the nerves of the muscles and integuments of the greater part of the body, and in the ordinary actions of the body what usually happens is this, that impressions made by the contact of external objects on the terminations of sensory nerves in the integument are transmitted by them to the nerve corpuscles of the cord, and, through series of these, conducted to the parts of the brain, which are in immediate connection with consciousness; while also, when the mind wills certain movements of the body, the stimulus proceeds from those parts of the brain, and, by some altogether unknown mechanism, is ultimately so distributed that there extend from the gray matter of the cord impressions along the nerves so adjusted as to produce precisely that amount of contraction of muscles, of whose existence the mind is utterly ignorant, which is necessary to effect the required result. But it is always the same kind of stimulus, the nervous influence, wherever

it issues from, which acts upon the cord. Thus, for example, when the cord near its upper part is severed from the brain by an injury, there is loss of all sensation and voluntary motion in the parts supplied by it below the place of lesion, the consciousness being no longer in communication with those parts; but irritation of the integument still sends a current as before to the spinal cord, and this being distributed by the corpuscles of the gray matter, and descending again by the motor nerves, causes involuntary contraction of muscles. This is probably the simplest possible example of the phenomenon termed by physiologists reflex nervous action.

We have ventured on this extremely cursory and general survey of the spinal cord, the simplest portion of the cerebrospinal axis, in order that the general reader may form some conception of the kind of mechanism which extends through the more obscure and intricate portion, the brain. To explain fully the extremely complex structure of the brain would require much greater detail than is allowable in an article like this, but a general idea of the most important facts will best be arrived at by pursuing the account of its early development, which we have already begun.

The cylinder which we have traced in the embryo, so far as the spinal cord is concerned, is immediately on its closure, expanded in its cranial part into a series of three primordial vesicles, and immediately afterwards two little hollow buds, called the hemisphere vesicles, project laterally from the foremost of the series. Without tracing the history of the primordial vesicles, it is sufficient for our present purpose to point out that the cerebellum is originally a part of the hindermost, projecting upwards as a hollow pouch, and that it is quite certain, from the experiments on lower animals, that no consciousness whatever resides in any of the parts developed from that vesicle; also it is equally certain that not more than the very feeblest consciousness resides in those parts into which the walls of the two other primordial vesi-

merely pointing out that the system is certainly a blunder; and their hearers have gone away impressed with the conviction that it is impossible for the uninitiated to argue with experts, yet saying in their hearts that they are sure there is a mistake somewhere, and unwilling to part with all their beautiful theories and get nothing in exchange. Iconoclasm is not popular: when an image is thrown down it is well that its destruction should make way for a flood of light sufficient to satisfy the eye in its stead. This is an achievement not easy to accomplish, but actuated with the laudable motive of attempting it, the writer will try, not only to reiterate the reasons why phrenology cannot possibly be true, but to give some idea of what is positively known regarding the brain and its functions, and to point out in what direction speculation may be still legitimately indulged.

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As respects texture, there is much in common between the brain and spinal cord. They are similar in appearance, and both consist of true nerve tissues, with a fine reticulum of supporting substance in which those more important elements are embedded. The proper nerve tissues are two in number, nerve fibres and nerve corpuscles: the nerve fibres are long threads which have the property of transmitting along their course a certain change of condition which constitutes nervous influence, and which, it may be mentioned, is a purely physical action, not electrical, but involving in its operation electrical changes. Nerve fibres transmit this influence, but have no power of originating, directing, or modifying it: they are simply conductors, and such nerve fibres are the essential elements in all the nerves throughout

the body. Nerve corpuscles are bodies of which it is only necessary to say that they present a variable number of poles or branches, and there is no reasonable doubt that these poles are in direct continuity with nerve fibres. According to circumstances little understood, these corpuscles have the property of modifying impressions or nervous influence, and of directing them into different channels with which their poles communicate. Now the white substance of the brain and spinal cord contains only nerve fibres without any nerve corpuscles, these latter being found exclusively in the gray substance. It is quite plain, therefore, and universally recognized, that the white substance is only useful as containing channels of communication between different parts of the gray, and also between the gray substance and the muscles and sensitive parts throughout the body. But even the gray substance is not always or even generally capable of being affected directly by the consciousness; and in the case of the spinal cord, it is very certain that consciousness resides in no part of it, either white or gray. The spinal cord is the centre with which are connected the nerves of the muscles and integuments of the greater part of the body, and in the ordinary actions of the body what usually happens is this, that impressions made by the contact of external objects on the terminations of sensory nerves in the integument are transmitted by them to the nerve corpuscles of the cord, and, through series of these, conducted to the parts of the brain, which are in immediate connection with consciousness; while also, when the mind wills certain movements of the body, the stimulus proceeds from those parts of the brain, and, by some altogether unknown mechanism, is ultimately so distributed that there extend from the gray matter of the cord impressions along the nerves so adjusted as to produce precisely that amount of contraction of muscles, of whose existence the mind is utterly ignorant, which is necessary to effect the required result. But it is always the same kind of stimulus, the nervous influence, wherever

it issues from, which acts upon the cord. Thus, for example, when the cord near its upper part is severed from the brain by an injury, there is loss of all sensation and voluntary motion in the parts supplied by it below the place of lesion, the consciousness being no longer in communication with those parts; but irritation of the integument still sends a current as before to the spinal cord, and this being distributed by the corpuscles of the gray matter, and descending again by the motor nerves, causes involuntary contraction of muscles. This is probably the simplest possible example of the phenomenon termed by physiologists reflex nervous action.

We have ventured on this extremely cursory and general survey of the spinal cord, the simplest portion of the cerebrospinal axis, in order that the general reader may form some conception of the kind of mechanism which extends through the more obscure and intricate portion, the brain. To explain fully the extremely complex structure of the brain would require much greater detail than is allowable in an article like this, but a general idea of the most important facts will best be arrived at by pursuing the account of its early development, which we have already begun.

The cylinder which we have traced in the embryo, so far as the spinal cord is concerned, is immediately on its closure, expanded in its cranial part into a series of three primordial vesicles, and immediately afterwards two little hollow buds, called the hemisphere vesicles, project laterally from the foremost of the series. Without tracing the history of the primordial vesicles, it is sufficient for our present purpose to point out that the cerebellum is originally a part of the hindermost, projecting upwards as a hollow pouch, and that it is quite certain, from the experiments on lower animals, that no consciousness whatever resides in any of the parts developed from that vesicle; also it is equally certain that not more than the very feeblest consciousness resides in those parts into which the walls of the two other primordial vesi-

cles are developed. These parts are devoted to the carrying on of obscure functions connected with the sensibility and movements of the body strictly comparable with the functions of the spinal cord, and entirely of a physical description: the organs of the mental faculties are the developed hemisphere vesicles, and these only. The hemisphere vesicles rapidly enlarge and extend backwards over and around the other parts of the brain, so as to reach to the cerebellum behind, come in contact with the whole roof and sides of the skull and a large part of its floor, and press one against the other in the middle line of the whole length of the skull for an average depth of a couple of inches; and early in embryonic life they are already much the most bulky parts of the brain.

The gray matter which lines the whole length of the cerebrospinal cylinder fails to be developed in the hemisphere vesicles, except at one part placed at the neck of the vesicle, and called by anatomists the corpus striatum, but of which we know nothing in respect of function, and can only note that it is traversed by the whole mass of fibres joining the hemisphere vesicles with the cord and cerebellum. The whole of the rest of the hemisphere vesicle, or, as it is termed, the cerebral hemisphere, consists of an enormous mass of white matter, with a superadded layer of gray matter on the outside. The cerebellum has the same peculiarity of having its gray matter on the surface, and it is curious to note that both the gray matter on the cerebellum and that on the cerebrum, while differing one from the other in minute structure, differ still more from the gray matter which is found elsewhere, and the function of which is, as we have seen, in a general way, well understood. Also the cerebellum and cerebral hemispheres resemble each other in being thrown into numerous elevations and depressions, in order to expose a larger extent to the vascular membrane on their surface, which sends its minute branches into them. These circumstances might plead a little for the doctrine that

the cerebellum is connecting with a psychical faculty, whatever that might be, but its totally different source of origin is clearly opposed to such a notion; and we are not left merely to speculate on the subject, for both disease in the human subject, and experiment on animals, teach us that when the cerebellum is destroyed, the power of combining movements so as to regulate and guide them is lost, the limbs being still capable of being moved, but walking and handling being impossible. Thus it is certain that the function of the cerebellum is totally different from what the phrenologists hold it to be.

Examining the cerebral hemispheres in different animals, and proceeding from the lower to the higher forms, a progress in development is found, similar to the progress made in embryonic life. Thus in fishes they are represented by very small parts in the fore part of the brain; in birds they have not extended sufficiently backwards to be in contact with the cerebellum, and their bulk is due almost entirely to the corpora striata; in rodent animals their surface is smooth; and, as one passes to the higher groups of mammals, more and more complicated convolutions of the surface are met with; while in man by far the greatest complexity is found.

Whatever the particular cerebral changes may be which accompany and are necessary for thought, there can be no question that they occur in the gray matter, and that the white matter is only useful by bringing the different parts of the gray matter into communication one with another, an end which it accomplishes very thoroughly by its complicated commissures and countless bundles of fibres taking all directions. Judging, then, from comparative anatomy, and even on phrenological principles, one would expect that, among men, the greater the amount of gray matter of a given quality the more effective would the hemisphere be for the exercise of the mental faculties; and this, there is good reason to consider, is to some extent actually the case. But

the quantity of gray matter varies according to other circumstances besides the size of the skull. The vertical depth at any one spot, from the surface of the gray matter down to the white, differs in different brains; and what is probably more important is, that the complication of the convolutions varies greatly. Complex convolutions are probably more important than the thickness of the sheet of gray matter, because it is obvious that not only quantity but activity of texture will be an advantage; and complexity of convolutions involves increased surface of vascular membrane, sending its blood-vessels into the gray matter, and furnishing its elements with the means of activity. In harmony with this supposition, the simplest condition of the convolutions has been found in the brains of the lowest races of humanity, and Wagner's comparisons of the brains of various persons of ability with others from persons of supposed limited intelligence show more complicated convolutions in the former than the latter, although at the same time exhibiting apparent exceptions to that rule. It may be noticed in this connection that if two skulls of the same cranial capacity be one long and narrow and the other short and broad, the long and narrow one is that which has the greatest amount of surface, and is therefore most favorable for a large proportion of gray matter; so that, *ceteris paribus*, the long skull has probably an advantage over the broad skull; while, on the other hand, there is no doubt that, with a given model of skull to start from, the tendency of expanding hemispheres is rather to increase the breadth than the length.

Turning now to the fundamental doctrine of phrenology, that different parts of the cerebral hemisphere are the organs of different mental faculties, we feel assured that no physiologist will hesitate in giving it a distinct and emphatic denial. It is true that the convolutions of the hemispheres are so constant that they are named; but the existence of the convolutions is not for the sake of dividing the hemispheres into parts, and does not do so, but only affords, as

has been said, facility for vascular supply; and, at all events, the convolutions have not the smallest correspondence with the phrenological organs which cross them, cut them up, and combine them in the most regardless fashion.

But the fatal objection to the doctrine of different functions in different parts is to be found in the teachings of experiment and pathology. An animal will bear to have its cerebral hemispheres gradually sliced away; and the slicing may be done in any direction with the same result, namely, gradually increasing stupidity, but with no change of character according as one or other phrenological organ is removed.

So also, persons have often recovered from wounds from which portions of the brain have protruded and been amputated, but it makes no difference what part of the hemisphere is injured; nor, in cases of tumors destroying portions of the hemispheres, is it at all possible to state the position of the tumors from any alteration in the mental constitution of the patient. The symptoms are perfectly irrespective of the part of the hemisphere affected.

Not only, however, are the hemispheres not divided into organs, but, supposing that such organs existed, it would be impossible to tell their size by the phrenological method. The bulging of any portion of the cranium vault does not indicate an increased thickness of the gray matter at that part, or give any clue to the degree of development of the convolutions opposite to the spot. Indeed, the shapes of skulls indicate differences of form in the central white matter of the hemispheres, rather than local differences of development of the gray matter on the surface. The sheet of gray matter is disposed with tolerably even thickness over great tracts, and always reaches its greatest complication of structure in the same region—namely, towards the back part.

It is not necessary to dwell at length on what has been discussed, *ad nauseam*, long years ago,—how one-half of the

surface of the hemisphere, namely, the part looking to the middle line and to the base, is beyond the reach of all phrenological observation; and how the most minute organs have been crowded by phrenologists over a part of the skull whose configuration is certainly not in the slightest degree affected by the form of the brain, namely, the line of bone immediately over the nose and eyes. But the accompanying figure speaks for itself. It has been obtained by tracing from a horizontal section of a skull, made half an inch above the orbit, dividing the phrenological organs of individuality, size, weight, color, and order, as indicated by Spurzheim, and passing quite above three still more nonsensical organs, viz., that of form, lying on the nasal cavity; calculation, which is never anything but the solid external orbital process of bone; and language, the so-called large size of which is an appearance of the eye dependent on want of projection forwards of the face bone on which it rests.

Turning now to the less special but more generally diffused notions respecting localization of different faculties in different parts of the skull, a few words may be said about fine foreheads. It may be freely granted that a handsome forehead is a beautiful feature, and one frequently, though by no means always or exclusively, met with in persons of talent; but a spacious and well-shaped forehead by no means necessarily indicates preponderance of the frontal lobes of the hemispheres over the others. This, with some other interesting points, will best appear by considering the general shape and mode of growth of the cranium. The cranial cavity, as has been already said, is originally the upper part of a long cylinder, the remainder of which becomes the spinal canal; and it may be regarded, even in its adult state, as a cylinder much modified and distorted. At an early embryonic period it is in all animals curved remarkably downwards on itself. Examining it, however, in adults, the total curvation of the cranial cylinder is seen to differ much in different species, becoming greater the higher the position

of the animal. This increasing curvature is accompanied with increasing expansion of the roof bones of the skull and arrest of the basal bones: thus in the human subject the roof bones are expanded far more than in any other animal, while the basal bones are crowded and even fused together by their position in the concavity of the curve of the cylinder. The human curve is not complete in infancy; for, as the present writer has elsewhere shown, it goes on increasing for several years after birth: it is also greater in the higher than in the lower races of mankind. This curvature is an important means of increasing the space for the cerebral hemispheres, by lengthening the roof; and it does so most effectually when accompanied with the other means which Nature uses to expand the cranium, namely, increase of vertical and transverse diameter of the cylinder.

Farther, before returning to the question of foreheads, it must be pointed out that the position in which the head is articulated with the neck differs in different persons, according to the weight of the fore and back parts, so as to preserve balance. This is best seen in the process of growth, for the forehead and face have the smallest proportional development in young children; and as they become large, the head is tilted farther and farther round on the top of the vertebral column, so as to throw more weight behind the point of support, to balance the weight in front: and this tilting takes place to a much greater extent in men than in women, because in women the face and forehead remain proportionally lighter.

From the foregoing considerations it must be apparent to every one that loftiness of forehead results from general height of the whole skull, and that the apparent form of the forehead is very dependent both on the amount of total cranial curvature and on the balance of the head on the vertebral column. The deceptiveness of mere general appearance may, perhaps, be best illustrated by noting how people speak of the large foreheads of children. The frontal emi-

nences of the child project forwards, and the head arches boldly above them, giving the appearance of a large forehead; but, in point of fact, the forehead of the child is proportionally very small and undeveloped; and its apparent prominence is due partly to the shallowness of the orbits, giving a comparative prominence to the frontal eminences, and partly to the whole skull being so set on the top of the spine that the forehead and face bones are turned more downwards than in the adult. The arch of the upper part of the child's forehead is afterwards lost, because it is turned back to lie more level on the roof of the head. So also, in the female, the head being not so much tilted up, there is a persistent upward arching of the roof of the skull, as it is traced backward, which is peculiarly feminine and graceful.

With regard to development of the back part of the skull, it has been justly remarked by some good observers, that fulness of that region appears to be quite as important as a full forehead; and it is instructive to note, that if a sketch be made of a head in profile, a change of expression, ranging from almost idiotic weakness to great strength of character, may be produced by varying the outline of the lower occipital region and back of the neck without altering any other portion. But the alteration of that line indicates not a mere addition to the posterior lobes of the brain or subtraction from them, but a change in the anatomy of the whole interior of the head, affecting the cerebral hemispheres throughout their extent.

So, also, those anatomists who have written as if the characteristic posterior lobes of the brain in man and apes were so much matter added to the back of the hemispheres, are really mistaken; for the hemispheres of a sheep rest against precisely the part of the cerebellum corresponding to that which they rest against in the human subject; but the human brain differs from that of the sheep in the vastly increased curvature and greater diameter of the cranial cylinder.

In bringing these cursory remarks to a conclusion, it is

only necessary to add, that the reader is not to imagine, because it has been argued that different faculties are not localized in different parts of the cerebral hemispheres, that therefore it follows that there is no connection between the shape of the head and the mental character. Let the reader who still preserves a lingering fondness for judging men by their appearance continue to take the skull into account, if he pleases; but let him be assured that whatever connection really exists is to be explained, not by the phrenological dogma, but as he would explain why massive chins are often conjoined with strong wills, different types of hand with different types of mind, well-built frames with healthy mental tendencies, and rickety bodies with eccentric, though often keenest-witted natures. The explanation is physiognomical.

While, however, this is probably the case with regard to the shape of the head, it is obvious that the relationship of the amount of brain to the mental faculties is more than physiognomical. Possibly an analogy may be drawn between the brain and a galvanic battery, and increase of the gray matter of the one be correctly compared with addition to the cells of the other; but as in an electric instrument the working is dependent on the delicacy and fitness of the arrangements quite as much as on the strength of the current which supplies them, so in the case of the mind the result is dependent on the distribution and balance of the faculties and inclinations, and on other circumstances, none of which are proved to have any connection with the mass of cerebral substance. Certain it is that, although there are probably mental characters peculiar to large and small brains respectively, the size of the skull is, as any observer may easily satisfy himself, no good guide to the mental endowments. —*Popular Science Review.*

THE CLAPPER RAIL.

BY DR. E. COUES, U. S. A.

THE Clapper Rail, otherwise called the Salt-water Marsh Hen, is a sea-side bird, inhabiting the marshes along our coast within reach of the tides, and rarely if ever straying inward. It goes as far north as Massachusetts, but only in summer, and is unfrequent or rare beyond the Middle States. Further south, however, it is one of the most abundant and characteristic of the maritime species. On the coast of North Carolina, for instance, it breeds in countless numbers, and remains nearly all the year—only becoming less numerous in winter, or perhaps disappearing altogether for a short time during the coldest weather. I presume that the reader is so familiar with the appearance of the bird, from seeing stuffed specimens, that I need say nothing on this score. But it may not be so generally known that the young birds, in the downy plumage, are jet black, with a faint gloss of green, looking much like newly-hatched chickens, except that the bill, and especially the feet, are longer. The former is flesh colored, the latter are dusky. And perhaps still less is known of the habits of this, as well as of other rails, which are particularly difficult to study satisfactorily. Rails live hidden in the marshes, and are not very often seen except when they fly up; so that how they live becomes a matter of some interest, as perhaps I may be able to show. We will begin with the eggs—*omne vivum ex ovo*, says ~~Linnæus~~ Harvey.

I have sometimes thought that the pains oölogists frequently take to measure eggs in hundredths of the inch, and describe their shape with mathematical exactitude, might be spared for something more profitable. I was never more struck by the fact that birds' eggs vary more than is usually

believed, than when looking over a peck, more or less, of these rails' eggs. They seemed to differ among themselves about as much as the same number of common fowls' eggs would. Let me illustrate by giving the measurements of half a dozen, selected as representing extremes:—

No. 1. The longest one, 1.80×1.10; elliptical, the ends about equally pointed; greatest diameter in the middle.

No. 2. The slenderest one, 1.66×1.00; same shape.

No. 3. A small one, 1.50×1.05; rather narrowly oval, pointed; greatest diameter across posterior third.

No. 4. A thick one, 1.60×1.16; a regular "oval" in shape.

No. 5. Another thick one, 1.70×1.20; like No. 4, but more obtuse at the small end.

No. 6. The shortest, and a very thick one for its length, 1.50×1.15; very broadly oval, or sub-spherical; diameter across the middle; scarcely appreciable difference between the two ends.

So the eggs of *Rallus crepitans* are an inch and two-thirds long, by an inch and one-tenth broad; narrowly or broadly oval; narrowly or broadly elliptical, or nearly spherical. The ground color ranges from a dull opaque white to a creamy or pale buff. They are rather sparsely, oftener very thickly, marked with spots evenly or very irregularly distributed over the surface; the spots varying from mere dots to large splashes, both on the same, or on different eggs. But when the markings vary in size on the same egg they are always largest and most numerous towards or at the butt, where also they are apt to run together; while they usually remain distinct on other parts of the shell. But it is not confluence of the small spots that makes the longer splashes; these are of a different character. The former are usually roundish, with a distinct contour; the latter have no definite shape. In color the markings are always reddish brown; whether paler or darker, they have the rusty or reddish tint, and are never pure brown. There are a number of other spots, more obscure than either of the foregoing, appearing as if in the shell instead of on the surface; these are some shade of lavender, lilac, or very pale purplish.

The number of eggs deposited varies; I never found more than seven in one nest, though I have been assured that eight or nine may be laid; six or seven is the average number, however. The laying season commences (here in North Carolina, at any rate) the last week in April, and continues until the middle of June, or later, as two broods are frequently raised. I found perfectly fresh eggs June 12th; and have seen barely fledged birds in August. But the second and third weeks in May are the great times for laying. Then, when the season is at its height, some idea of the countless numbers of rails in the marshes may be gained from the fact that baskets full of the eggs are gathered by the boys (and men too) and brought to the Beaufort market, where they sell for about five cents a dozen. When perfectly fresh they are very good to eat.

We occasionally read in books, scientific and otherwise, accounts of the nests of rails and coots being floated off by the tide without going to pieces, and the parent bird continuing to incubate, with undisturbed peace of mind, during the whole voyage. I suppose such a thing may have happened; at any rate, a lively imagination is well enough, and it is a pity to spoil a good story by asking impertinent questions. But I must say I never saw a rail's nest substantial enough to hold together for any length of time floating on the water; and, moreover, that a good deal that has been said about their being skilfully moored to tussocks of grass, rising and falling with the tide, etc., may be taken with much salt. In fact, destruction of numberless nests, addling of eggs, and drowning of newly-hatched young, are foregone conclusions from every unusual rise of the tide, as during a severe storm. A great tragedy of this sort happened at Fort Macon, on the 22d of May, 1869, when, and for two or three days afterward, the marsh, ordinarily in greatest part above water, was flooded—only here and there a little knoll breaking the monotony of the water. There was a terrible commotion among the rails at first, in prospect

of the common calamity; and the reeds resounded with their hoarse cries of terror. But as the waters advanced, and inundated score after score of homes, the birds became silent again as if in unspeakable misery. Driven from their concealment, anxious or terrified, as the case might be, they wandered in listless dejection over beds of floating wrack, swam aimlessly over the water, or gathered stupefied in groups upon projecting knolls. Few of the old birds, probably, were drowned, but most of the young must have perished. A dark day for the rails!

As if to guard somewhat against such an accident, the rails generally build their nests around the margins of the marsh, or in elevated and comparatively dry spots in its midst, just about at the usual high water mark. The nest is always placed on the ground, in a bunch of reeds or tussock of grass, or clump of little bushes. It is an artless flimsy structure, made of dried grasses, or reed stalks broken (probably bitten) into pieces three or four inches in length, laid crosswise and matted together, but scarcely intertwined. It is simply a platform of such materials, say a foot in diameter, and two or three inches thick, slightly hollowed in the middle. Sometimes it is barely thick enough to keep the eggs from the wet; sometimes quite a heap of materials is made; this seems to depend in great measure upon the comparative dryness of the situation selected. But in any case the nest is so frail and so bulky that it is difficult or impossible to lift it up without its coming to pieces.

The rail is not a natatorial bird properly speaking. It has only a very slight basal web, and no vestige of a marginal fringe or lobe along the toes. Nevertheless, it swims very well, at least for short distances. I have often seen the birds take to the water by choice, not from necessity; and noticed that they swam buoyantly, if not very fast, and with perfect ease; much like coots, for example. In consequence of the compressed shape of the body, they rest rather deeply in the water; but carry the head well elevated,

the neck drawn back, and the tail cocked up. They are poor flyers, as every one knows; so poor, it seems, that it is somewhat a matter of surprise that some of the family perform such extensive migrations. When started on wing, a thing not easy to effect, except at high tide, they fly up in a remarkably weak, vague way, flap hurriedly a little distance, and settle suddenly again, with a peculiar motion of the wings, as if simply letting themselves drop. This circumstance makes these and other kinds of rails—they are all alike in this respect—the very easiest of all birds to shoot on the wing; and is one reason, perhaps the chief, that so many people are fond of rail-shooting. The birds in fact are not distinguished either as flyers or swimmers; their strong point is walking. As walkers, they have "few equals and no superiors." A glance at their long strong legs is sufficient to establish this fact, without the trouble of going into a marsh, and observing how every square foot of soft mud is marked with the impress of their feet—all the impressions made of course since the last tide. The rails' attitudes are not easily learned; when seen, the birds are generally in too much of a hurry for this, but some of their poses are extremely graceful. Audubon has caught them best of any one who has attempted their delineation. As any one will notice, who has an opportunity of seeing a rail leisurely stepping about, in fancied security, there is a connection between the muscles of the tail and legs. With every step there is a corresponding jerk of the tail, apparently involuntary, and regular as clock-work. The same movements are repeated by the head and neck, as in most birds; they all tend to secure in equilibrio the forces acting upon the centre of gravity, as this is thrown now over one, now over the other leg. The remarkable compression of the body, that enables the birds to pass between close-set reeds, need not be enlarged upon. The expression "thin as a rail," refers, I take it, to these birds, and not to what fences are made of; at least, if it doesn't, it might.

In the matter of food the Clappers are not over particular. They feed indiscriminately on all the small animals they find in the marsh, as well as on seeds. The little crabs known as "mud-fiddlers," however, are, in this locality, the chief article in their bill of fare. These have squarish bodies, generally less than an inch long; the smaller ones are swallowed whole; the larger ones get their legs, and particularly their one great claw, beaten off, before they find rest at last in a rail's gizzard. If one has the patience and good luck to be able to watch rails when the birds are securing and disposing of their prey, he will see that they do it much after the fashion of the smaller herons, as the Green, for instance. But the rails race after their meals more than herons do; there is less patient lying in wait, and altogether less "action" in the final blow.

Rails are among the most harmless and inoffensive of birds. All that they seem to want is to be let alone. But when wounded and caught, they make the best fight they can, and show good spirit. The bill is too slender and weak to be much of a weapon, and they scarcely attempt to use it; relying rather upon their sharp claws, which they employ to considerable effect.

A colony of rails, goes far towards relieving a marsh of part of its monotony. Retiring and unfamiliar as they are, and seldom seen, considering their immense numbers, yet they have at times a highly effective way of asserting themselves. Silent during a great part of the year, or at most only indulging in a spasmodic croak now and then, during the breeding season they are about the noisiest birds to be found anywhere. Let a gun be fired in the marsh, and like the reverberating echoes of the report, a hundred cries come instantly from as many startled throats. The noise spreads on all sides, like ripples on the water at the plash of a stone, till it dies away in the distance, only however to be repeated again upon the slightest provocation—or none. In the morning and evening, particularly, the rails seem perfectly

reckless, and their jovial, if unmusical, notes resound till the very reeds seem to quake. It is as if some irresistible joke was going the rounds, making every bird laugh outright as soon as it was told. With scarcely a change of name, in fact, the Clapper Rail's nature, and function in bird-society, is perfectly expressed. It should be spelled in French style —*claqueur*. Unobtrusive, unrecognized except by a few, almost unknown to the uninitiated, the birds steadily and faithfully fulfil their allotted parts; like claqueurs they fill the pit, ready at a sign, to applaud anything—or nothing—that may be going on in the drama of life before them.

I do not wish to be tedious; but I have a story that I can vouch for as being something new. It is "another rail-road accident;" when will public opinion force the companies to be more careful? Suppressing an obtrusive pun upon iron and other rails, for it is unbecoming to joke over a melancholy case of suicide, I will merely say that a rail was found lying dead upon the track that divides two pieces of marsh at Fort Macon. Now we have all read certain singular stories, perhaps in "Ord's Wilson," to the effect that rails are subject to remarkable spells of fear or anger, or something of that sort, that throw them into epileptic fits. I thought at first, here was a real case in point; for the bird was dead, yet without a sign of external violence, even so much as the ruffling of the plumage. Stooping to pick him up, however, I found that he had got both legs wedged fast in the crack between the ends of two contiguous rails; he was in fact so firmly caught that I had some little trouble in liberating his dead body. He had evidently tried to walk between the rails instead of stepping over them; but how he ever managed to "put his foot in it" so effectively I cannot imagine, for there was not a fourth of an inch of space. Still the fact remains. In the inquest held upon this unlucky rail—victim of the "blind decrees of fate," as the novelists say—I discovered abundant cause of death, without falling back upon any hypothesis of mental emotion. He had beat him-

self to death against the iron. Both shoulder blades and one coracoid were broken; the other coracoid was dislocated; there was a double fracture of the merry-thought, and a crack in the keel of the breastbone; while all the muscles of the breast were terribly bruised, and full of blood-clots.

REVIEWS.

HUXLEY'S CLASSIFICATION OF ANIMALS. *Continued from Page* 546.— Professor Huxley very clearly sets forth the characteristics of the group, or Subkingdom, of VERTEBRATA, and as plainly indicates the three Provinces into which it is divisible, viz: I. The ICHTHYOPSIDA, comprising the Fishes and Amphibians; II. The SAUROPSIDA, comprising the Reptiles and Birds; III. The MAMMALIA. These three groups are certainly well marked, and the affinities of their members have for a long time been noticed and agreed to. No one can doubt the close relationship existing between the Fishes and Amphibians (Salamanders, Frogs, etc.,); and since the discovery of the remarkable fossil form of *Archæopteryx*, which has been placed alternately in the classes of Reptiles and Birds, the characters of these two classes have been so thoroughly sifted as to prove their close affinity; neither can the distinctive characters of the class of Mammalia be questioned, though as has often been pointed out, and as Prof. Huxley also insists upon, the Mammals, Birds and Reptiles, or the *Abranchiate Vertebrata*, have certain characteristics in common, distinguishing them from the equally well defined group of Amphibians and Fishes, or the *Branchiate Vertebrata*.

In adopting M. de Blainville's three primary divisions of the Mammalia, as characterized by the reproductive organs, especially those of the female, Prof. Huxley states that he does "not mean to assert that M. de Blainville defined these different groups in a manner altogether satisfactory, or strictly in accordance with all the subsequently discovered facts of science, but his great knowledge and acute intuition led him to perceive that the groups thus named were truly natural divisions of the Mammalia. And the enlargement of our knowledge by subsequent investigation seems to me, in the main, only to have confirmed De Blainville's views." These primary divisions, or subclasses, are the *Ornithodelphia*, containing only the genera Ornithorhynchus and Echidna; the *Didelphia*, or the Marsupials; and the *Monodelphia*, embracing all the rest of the orders of the class, which, from "placental" characters, he places in five groups. Without either endorsing or attempting to disprove Prof. Huxley's views in relation to the special classification of the Mam-

reckless, and their jovial, if unmusical, notes resound till the very reeds seem to quake. It is as if some irresistible joke was going the rounds, making every bird laugh outright as soon as it was told. With scarcely a change of name, in fact, the Clapper Rail's nature, and function in bird-society, is perfectly expressed. It should be spelled in French style —*claqueur*. Unobtrusive, unrecognized except by a few, almost unknown to the uninitiated, the birds steadily and faithfully fulfil their allotted parts; like claqueurs they fill the pit, ready at a sign, to applaud anything—or nothing—that may be going on in the drama of life before them.

I do not wish to be tedious; but I have a story that I can vouch for as being something new. It is "another rail-road accident;" when will public opinion force the companies to be more careful? Suppressing an obtrusive pun upon iron and other rails, for it is unbecoming to joke over a melancholy case of suicide, I will merely say that a rail was found lying dead upon the track that divides two pieces of marsh at Fort Macon. Now we have all read certain singular stories, perhaps in "Ord's Wilson," to the effect that rails are subject to remarkable spells of fear or anger, or something of that sort, that throw them into epileptic fits. I thought at first, here was a real case in point; for the bird was dead, yet without a sign of external violence, even so much as the ruffling of the plumage. Stooping to pick him up, however, I found that he had got both legs wedged fast in the crack between the ends of two contiguous rails; he was in fact so firmly caught that I had some little trouble in liberating his dead body. He had evidently tried to walk between the rails instead of stepping over them; but how he ever managed to "put his foot in it" so effectively I cannot imagine, for there was not a fourth of an inch of space. Still the fact remains. In the inquest held upon this unlucky rail—victim of the "blind decrees of fate," as the novelists say—I discovered abundant cause of death, without falling back upon any hypothesis of mental emotion. He had beat him-

self to death against the iron. Both shoulder blades and one coracoid were broken; the other coracoid was dislocated; there was a double fracture of the merry-thought, and a crack in the keel of the breastbone; while all the muscles of the breast were terribly bruised, and full of blood-clots.

REVIEWS.

HUXLEY'S CLASSIFICATION OF ANIMALS. *Continued from Page 546.*— Professor Huxley very clearly sets forth the characteristics of the group, or Subkingdom, of VERTEBRATA, and as plainly indicates the three Provinces into which it is divisible, viz: I. The ICHTHYOPSIDA, comprising the Fishes and Amphibians; II. The SAUROPSIDA, comprising the Reptiles and Birds; III. The MAMMALIA. These three groups are certainly well marked, and the affinities of their members have for a long time been noticed and agreed to. No one can doubt the close relationship existing between the Fishes and Amphibians (Salamanders, Frogs, etc.,); and since the discovery of the remarkable fossil form of *Archæopteryx*, which has been placed alternately in the classes of Reptiles and Birds, the characters of these two classes have been so thoroughly sifted as to prove their close affinity; neither can the distinctive characters of the class of Mammalia be questioned, though as has often been pointed out, and as Prof. Huxley also insists upon, the Mammals, Birds and Reptiles, or the *Abranchiate Vertebrata*, have certain characteristics in common, distinguishing them from the equally well defined group of Amphibians and Fishes, or the *Branchiate Vertebrata*.

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malia, we will simply compare the results of his system with those of the equally carefully considered one of Owen published ten years before. Both are strictly anatomical and confined (so far as tabulating the results are concerned) to one set of organs: Owen taking the modifications of the brain; Huxley the generative organs, or more especially the uterus and the placenta in connection with the development of the embryo.

Owen divides the Mammalia into *four* subclasses; Huxley into *three*.

Owen's first three subclasses (the *Archencephala*,—Man; the *Gyrencephala*,—Ape, Lemur, Dog, Bear, Seal, Hog, Sheep, Horse, Tapir, Elephant, Manatee, Whale, etc.; and the *Lissencephala*,—Sloth, Armadillo, Anteater, Bat, Mole, Hedgehog, Shew, Hare, Rat, etc.) are contained in Huxley's subclass *Monodelphia*.

Owen's fourth subclass (*Lyencephala*,—the Marsupials, and Echidna and Ornithorhynchus) is divided into two subclasses by Huxley, corresponding to the two *orders* of Owen, viz: subclass *Didelphia* of Huxley=order Marsupialia of Owen; and subclass *Ornithodelphia* of Huxley=order Monotremata of Owen.

The result of this comparison of two anatomical systems is favorable to the generally received orders of the class being established on firm grounds, for, with the exceptions following in parenthesis, both Huxley and Owen, though investigating from different stand points, have kept the orders intact, and have only changed the order of their relation, or succession, in accordance with the views each has taken regarding the value of groups more comprehensive than orders. (Man is considered by Owen as differing from all other Mammals in the cerebral character, and hence considered as a subclass; while Huxley, from the identity of the placenta with that of the Apes, Lemurs, Insectivora, Chiroptera and Rodentia, unites him with them in the group of Monodelphia with a *discoidal deciduate placenta*, but retains him as a suborder of the order of PRIMATES, which contains two other suborders, the *Apes* and the *Lemurs*, corresponding to Owen's order of Quadrumana. Huxley unites Owen's orders Perissodactyla and Artiodactyla — containing together the Tapir, Horse, Sheep, Hog, etc. — as two suborders under his order of UNGULATA, which, with the Cetacea, are united in a group characterized by the *non-deciduate placenta*. Huxley considers the genus *Hyrax* as the sole representative of a distinct order, removed to the next group, with the Proboscidia and Carnivora, having a *zonary deciduate placenta*).

After noticing the results of this hasty comparison, may we not ask why the character of the brain (provided the results are well founded by examination in such a manner as to leave no doubt of their correctness) should not be as good a guide as the anatomical structure of the uterus and placenta? It has been stated that in some respects the Cerebral system is liable to lead to errors. On the other hand, we read in Huxley's work that there is doubt as to the real position that some of the animals should hold in his system, on account of the very character he has taken for the basis of his classification not being known in some, and in others

liable to be differently understood, and he admits (p. 72) that the placenta, the peculiar character of which he takes for his guide in defining the five groups of the Monodelphia, is "a structure not universally characteristic of the class." With these exceptions and gaps taken into account, in addition to the limitation of the placental characters to one sex, is not the Cerebral system as likely to lead to a natural grouping of the orders of Mammalia as one based on the reproductive organs?

From what we have stated it must not be supposed, by those who have not yet read Prof. Huxley's invaluable résumé of the classification of the Mammalia, that the author has confined himself to considerations resulting from the study of the reproductive organs, for, on the contrary, while their peculiar structure, and the development of the embryo and its relation to the parent, forms the basis of his division of the class into three subclasses, and the structure of the placenta that of the five secondary groups of the principal subclass; he also gives other characters common to each group, and in his summary of the orders he brings together their principal structural elements, and discusses their relations from other stand points, for an understanding of which we must refer the reader to the work itself.

Without farther comments — other than to state that it is our belief that the orders of the birds will require farther confirmation before they are generally adopted by ornithologists, and remarking that the orders of the Reptilia and Amphibia are mainly those now commonly received — we give the groupings of his second Province, the SAUROPSIDA.

Class I. BIRDS (*Aves*), he divides into three orders: — (1) SAURURÆ, containing only the extinct form, *Archæopteryx;* (2) RATITÆ, containing the Ostriches, Emeus, Apteryx, etc.; (3) CARINATÆ, containing all the ordinary birds.

Class II. REPTILES (*Reptilia*), he divides into four orders of living and five of fossil forms: — (1) CROCODILIA (Crocodiles, Alligators, and their allies); (2) LACERTILIA (Lizards, Blindworms and Chameleons); (3) OPHIDIA (the Snakes); (4) CHELONIA (the Turtles and Tortoises). The five orders represented only by fossils are the ICHTHYOSAURIA, the PLESIOSAURIA, the DICYNODONTIA, the PTEROSAURIA and the DINOSAURIA.

The third Province, the ICHTHYOPSIDA, containing the classes of Amphibians and Fishes, is arranged as follows: —

Class I. AMPHIBIANS (*Amphibia*). Four orders: — (1) URODELA (the Newts, Salamanders, Sirens, etc.); (2) BATRACHIA (the Frogs and Toads); (3) GYMNOPHIONA (the Cæcilians, etc.); (4) LABYRINTHODONTA (fossil forms).

Class II. FISHES (*Pisces*). Six orders: — (1) DIPNOI (containing only the singular "Mud fishes," *Lepidosiren* and *Rhinocryptis*); (2) ELASMOBRANCHII (Sharks, Skates, and Chimæras); (3) GANOIDEI (Sturgeons, Garpikes, Dogfish (*Amia*), etc.); (4) TELEOSTEI (the ordinary "Bony" fishes); (5) MARSIPOBRANCHII (Lampreys, etc.); (6) PHARYNGOBRANCHII (represented by the single genus *Amphioxus*).

In this classification of fishes Prof. Huxley has simply followed the groups of Müller, given twenty-three years ago, but has lowered the rank of the groups from subclasses, as they were considered by Müller, to orders. These groups are undoubtedly well founded, but their equality of rank may be questioned. The *Dipnoi* are very Amphibian in many of their characters, and the typical *Ganoidei* are equally Reptilian in some of theirs, both agreeing, however, in much that is important in their anatomy (five out of the eleven characters assigned by Huxley to Dipnoi being common to the Ganoidei as well, and the other six characters are either of an aberrant or embryonic nature). The *Elasmobranchii* are equally an aberrant group, with affinities to the higher classes of Birds and Mammals. The *Marsipobranchii* are low, degradational, or embryonic forms, when relatively considered with the other groups of the class; and the single genus of the *Pharyngobranchii* is of so low an embryonic type that it must be considered as representing a distinct subclass, unless the embryology of the lower Marsipobranchiates shall prove it to be the lowest order of that subclass. The *Teleostei* are the most fish-like of fishes, agreeing more nearly with the Ganoidei than with the other groups. Are these six groups of equal value? and if so do they rank as subclasses or as orders? and what is the rank of the groups into which all but the Dipnoi and Pharyngobranchii are most naturally subdivided? If the same considerations used to discriminate the orders among Mammals, Reptiles, or Amphibians be applied to the fishes, will not the secondary divisions of the groups Teleostei, Elasmobranchii, Ganoidei and Marsipobranchii by force be considered as orders? On these considerations we agree with Prof. Gill, who in 1861, in a discussion of the subject of the higher groups among fishes (Proc. Philad. Acad Nat. Sci.), united the Dipnoi with the subclass of Ganoids, considering them only of equal rank with his other three orders of the subclass. The Pharyngobranchii, which Prof. Gill considers as an order of the Marsipobranchii, we keep as a distinct subclass, subject to change on farther knowledge of the embryology of the Marsipobranchiates.

Our views of the higher groups might be expressed thus:—

Class PISCES.
Typical.
Subclass TELEOSTEI.

Aberrant.
(Mammalian and Avian.)
Subclass ELASMOBRANCHII.

Aberrant.
(Reptilian and Amphibian.)
Subclass GANOIDEI.

Degradational.
Subclass MARSIPOBRANCHII.

Embryonic.
Subclass PHARYNGOBRANCHII.

We confess ourselves much disappointed in that part of the work which relates to the Mollusca. Though the general facts and special details of the anatomy are clearly stated, no notice is taken of the plan or arche-

typal characteristics of the branch, which were admirably defined by Carpenter in 1854, and by Dana in 1863, and Mr. Morse in 1865,* and nothing is said of the embryology of either the animals or the shells, omissions which are unpardonable in an essay on classification.

The subdivision of the branch into Mollusca and Molluscoida also appears to us objectionable. If Prof. Huxley had drawn his dividing line between the Lamellibranchs and Pteropods we should have had an eminently natural division of the Mollusca, but in placing the line between the Lamellibranchs and the Ascidians he repeats a common error.

The Polyzoa, Brachiopoda, Ascidia and Lamellibranchiata have to the Pteropoda, Gasteropoda and Cephalopoda, within their own type, a negative relation comparable to that which the invertebrata have to the vertebrata; they are, when contrasted with the last three classes, as a whole, without a special cephalized extremity. All the three higher classes have the cephalic region distinctly differentiated from the mantle, or cœnœcial region, whereas in all the lower classes the organs of this region are buried in the mantle, or cœnœcial region, except among the Polyzoa, where they are distinct from the cœnœcial region, and may be extended in the higher genera, but this differentiation is gained only by elevating the cephalic organs to the posterior pole of the body.

The close structural affinities of the Polyzoa and Brachiopoda are noticed; the two divisions are placed in their correct sequence, and their relations to the Ascidia are defined with equal precision and correctness; but the author fails to see the close affinity of the latter to the Lamellibranchiata. Nevertheless the differences between the structure of the Lamellibranchs and Ascidians are no greater than those existing between the structure of the Polyzoa and the Brachiopoda, whilst the homologies existing between the Ascidia and the Polyzoa are of a much more general character than those existing between the Ascidians and the Lamellibranchs.

The Polyzoa and Brachiopoda together may be considered as one anatomical type, and defined as a sac closed at one end by a disc, surrounded by free tentacles, and perforated by an edentulous mouth from which hangs the alimentary canal.

Among the Ascidia and Lamellibranchiata on the other hand the tentacles, or gills, are always joined by an intermediate membrane, and they together with this membrane form either an open or closed pouch perforated at its lower end by the mouth, from which hangs the alimentary canal.

The atrial chamber has but one aperture in an invaginated Polyzoön or a Brachiopod, whereas with the Ascidia and Lamellibranchiata there are two. The muscular systems of the Brachiopoda and Polyzoa are complicated and homologically similar, as shown by several writers,

*Carpenter's Comparative Physiology, Dana's Manual of Geology, and Mr. Morse's Classification of the Mollusca in the Proceedings of the Essex Institute.

whereas the Ascidia have no distinct muscles which can be compared to those intersecting the visceral cavities of the Polyzoa and Brachiopoda.

Mr E. S. Morse has lately shown (September number of the NATURALIST) that the closest resemblance exists between the young of Terebratula and the adult Polyzoön, so close that there would be no hesitation in placing them in the same class, if the characteristics of the former were permanent.

In fact we cannot coincide with those who consider that the principles of the Cuvierian classification are endangered by Mr. Huxley's book. While no champion of all of Cuvier's principles, we cannot but regard any work which wholly sets them aside as very deficient in comprehensiveness; it must necessarily substitute a multitude of details for the very general anatomical statements by which four out of the five great branches of the animal kingdom are usually defined.

THE SHEFFIELD SCIENTIFIC SCHOOL.*—Prof. Verrill reports that the want of funds in the Zoölogical department has prevented the usual increase of specimens, but that the time has been turned to good account in cataloguing and classifying the general collection, and writing monographs of separate groups. Mr. S. I. Smith has monographed a part of the Decapods, and Prof. Verrill the Polyps and Corals of the west coast of America, and described numerous new forms.

The Geological department, under the direction of Prof. O. C. Marsh, has received several very valuable additions. Among these the most remarkable is a slab with twenty-one footprints of the Otozoum upon it, each of which is about fifteen inches in length. The slab is of a correspondingly gigantic size, measuring twenty by thirty feet.

We have not space to review other departments, but regret to notice that all of them seem to be laboring under pecuniary difficulties.

At Yale we really have a Scientific School, one which gives young men a general knowledge of science and the arts as well as a more intimate acquaintance with some special branch.

The advantages presented by the school in its mode of organization, its corps of instructors and the objects which it seeks to attain for all its students, are of the highest order. We hope, therefore, that the pecuniary hindrances to the future progress of an institution, so important to the general interests of education in this country, may be speedily removed.

NEW ECHINODERMS AND CORALS.†—In this paper Prof. Verrill describes seven new species of Echinoids, five of Asterioids, six of Ophiuroids, and six new species of coral, with one new genus among the Eupsammidæ.

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* Fourth Annual Report of the Sheffield Scientific School of Yale College, pamph., 8vo, 76 pp. New Haven, 1869.

† On New and Imperfectly Known Echinoderms and Corals. By A. E. Verrill. Ext. Proc. Bost. Soc. Nat. Hist., Vol. xii, pp. 382–96.

THE RULES OF ZOÖLOGICAL NOMENCLATURE.*—In republishing these rules accompanied by many valuable notes and comments, Prof. Verrill has done good service to zoölogy in this country. A copy of these rules and those of the British Association, reviewed by Prof. Gray in a previous number of Silliman's Journal, should be in the hands of every zoölogist.

NATURAL HISTORY MISCELLANY.

BOTANY.

ARTIFICIAL PREPARATION OF SUBSTANCES FOUND IN PLANTS AND ANIMALS.—Dr. Debus, the President of the Chemical Section of the British Association, states: "It has already become possible to prepare in the laboratory bodies of a very complex character, and which a few years ago were only found in the bodies of animals or plants. Alizarine, the beautiful compound of the madder-root, has been obtained by artificial means in the course of the year by Messrs. Liebermann and Græbe. Results of such a nature render it highly probable that, at no distant period, it will be in our power to prepare, artificially, nearly all, if not all, the substances found in plants and animals. Here I must not be misunderstood. Organic structures, such as muscular fibre or the leaves of a tree, the science of chemistry is incapable of producing, but molecules, like those found in a leaf, or in the stem of a tree, will no doubt one day be manufactured from their elements.—*Scientific Opinion.*

MAPLE-SEED, THREE WINGED.—I know not if it be common, and, therefore, ask for information, but on a tree of the *Acer saccharinum*, or sugar maple, in the Central Park in this city (New York) I found, a few days since, a three-winged seed. The description of the genus says, "ovary 2-celled. From the back of each ovary grows a wing, converting the fruit into two 1-seeded, at length separable, closed samaras or keys." (Gray.) I only found this one, though the trees were covered with seed, and I searched pretty carefully for more.—A. M. E.

ZOÖLOGY.

KINSHIP OF ASCIDIANS AND VERTEBRATES.—The number of Max Schultze's Archiv (v. 4), just published, contains a letter to the editor from Prof. Kupffer of Kiel, in which that distinguished embryologist asserts that he has been studying the early history of a species of Phallusia, and that his results in large measure agree with those of Kowal-

*From the American Journal of Science and Arts, November, 1869, at Naturalists' Agency 27 cents.

ersky touching the startling vertebrate features of the early condition of these invertebrata. He reserves for the present the details about the exact formation of the nervous system, but quite confirms the fact of the existence of a notochord. He says: "At this stage one could not imagine a more beautiful model of a vertebrate embryo, with the neural tube on one side of the axis and a visceral tube on the other." He, moreover, describes in his species of Phallusia the neural tube as not merely an almost spherical vesicle, but as prolonged in the form of a fine hollow thread into the tail above the notochord or axis. He promises full details shortly, and we hope to be able to return to this most important matter. — *Nature, London.*

House Wrens. — I have had the pleasure of being acquainted with these little birds (*Troglodytes ædon*) for several years. They have bred in and around my house, until they have become so tame as sometimes to allow the children to handle them. They have become so numerous that I do not furnish boxes for all, and they make nests in many singular places; among others, in a bullet-pouch up chamber, a soldier's knapsack in an outbuilding. In both of these places the birds succeeded in rearing a brood. But the most singular place selected for a nest was the wooden stirrup of a saddle hanging in a shed, in which, however, the birds did not prosper, as the saddle was often used. They carried small dry twigs and other rubbish, consisting of pieces of steel wire, dried snakes' skin, etc., into the knapsack, enough to have filled a half bushel measure, filling the entire cavity, except a little corner which they lined with feathers, where they laid seven or eight eggs. I also noticed their superior instinct, if not reason, whilst building in a box near my kitchen door. The hole in the box would not admit the long twigs the birds tried to get in, and they fell to the ground. After many efforts and failures the wrens concluded by making a scaffolding, which they succeeded in doing by taking in several shorter sticks endwise, letting the ends project out of the hole; then they proceeded by laying the long twigs on these projecting ends, then getting into the box, and by sliding the long twig endwise until the end came opposite the hole, they pulled it in. I was amused to see one trying to carry a large nail heavier than itself. They are amusing little fellows in many ways. Their song is melodious, loud and clear, and I have often wondered that such loud music could be produced by anything so small. — Wm. J. McLaughlin, *Centralia, Kan.*

Deep Sea Dredging off the British Isles. — Our Admiralty, at the instance of the Royal Society, placed a war steamer at its disposal for sounding, dredging, taking deep sea temperatures, and making other physical investigations. The steamer left about the middle of May; and I had charge of the expedition for the first cruise of two months. Prof. Wyville Thomson succeeded me; and Dr. Carpenter followed. We dredged at depths varying between ten and two thousand four hundred and thirty-five fathoms, everywhere getting mollusca, crustacea, and other inverte-

brate animals, in a living state. This expedition embraced the Atlantic Coasts of Ireland, the Hebrides, and Shetland. There was not any trace or indication of the Gulf Stream, but on the contrary, a northern fauna even as far south as Ushant. Many novelties occurred. — J. GWYN JEFFREYS (*in a letter to one of the editors*).

THE KINGFISHER'S NEST. — I have watched with some interest all that has been said in the NATURALIST about the breeding habits of this species, to see if my experience would be justified by that of any other observer. This has been nearly accomplished by Mr. Jones in the March number.

On the 18th of March, 1868, I collected eggs from two nests built near a mill-pond, in the excavation for the dam. Each hole was three feet deep; one elbowed to the right, the other to the left. In one was six eggs, in the other seven; all fresh. Each nest was composed of dry fish scales and small dry fish bones mixed with small pebbles of the size of a small pea. The scales and bones were free from smell, and were white and pure, and in each nest amounted to a fair handful.

About the first of June, 1869, on landing from a fishing excursion on one of our small lakes, I observed what I took to be a kingfisher's hole in a sandbank on the shore. While my bait and tackle were being loaded, I took a paddle and began to dig it out. The sand was soft and I proceeded five feet very rapidly, when the bird came rushing out. I went on digging with renewed hopes and made seven feet, when the paddle was no longer available for insufficient length, and I abandoned the job. — D. DARWIN HUGHES, *Marshall, Mich.*

SPECTRUM OF THE FIRE-FLY. — The spectrum given by the light of the common Fire-fly of New Hampshire (*Photinus?*) is perfectly continuous, without trace of lines either bright or dark. It extends from a little above Fraunhofer's line C, in the scarlet, to about F in the blue, gradually fading out at the extremities. It is noticeable that precisely this portion of the spectrum is composed of rays, which, while they more powerfully than any others affect the organs of vision, produce hardly any thermal or actinic effect. In other words, very little of the energy expended in the flash of the Fire-fly is wasted. It is quite different with our artificial methods of illumination. In the case of an ordinary gas light the best experiments show that not more than one or two per cent. of the radiant energy consists of *visible rays;* the rest is either invisible heat or actinism; that is to say over ninety-eight per cent. of the gas is wasted in producing rays that do not help in making objects visible. — C. A. YOUNG.

DEATH OF B. D. WALSH. — We regret to record the death of Mr. B. D. Walsh, the State Entomologist of Illinois, and the Senior Editor of the "American Entomologist," and former Editor of the "Practical Entomologist." For these duties he was admirably fitted. As an enthusiastic and thorough naturalist the small band of entomologists in this country will mourn his loss.

GEOLOGY.

A FOSSIL TUBULARIAN. — Dr. P. Martin Duncan has discovered, conjointly with H. M. Jenkins, a new genus of tubularian Hydrozoa from the Carboniferous formation. It is called Palæocoryne, and was described in a paper read at one of the late meetings of the Royal Society. *Palæocoryne* is a new genus containing two species, and belongs to a new family of the Tubularidæ. The forms described were discovered in the lower shales of the Ayrshire and Lanarkshire coal-field, and an examination of their structure determined them to belong to the Hydrozoa, and to be parasitic upon Fenestrellæ. The genus has some characters in common with Bimeria (Str. Wright), and the polypary is hard and ornamented. The discovery of the trophosome, and probably part of the gonosome of a tubularine hydrozoön in the Palæozoic strata brings the order into geological relations with the doubtful Sertularian Graptolites of the Silurian formation, and with the rare Medusoids of the Solenhofen stones. — *Popular Science Review.*

ANSWERS TO CORRESPONDENTS.

A. E. T., Springfield, Ohio. — Your aquatic plant is a Bladderwort (*Utricularia intermedia*), one of many species found in the United States in ponds, either floating free or rooting in the mud on the margin of the water. The name is derived from the little bladders which support it in a floating condition. The flowers are very pretty, usually yellow, but in some species purple. — J. L. R.

S. M. C., Otisco, N. Y. — The best work on American Neuroptera is Hagen's Synopsis of the Neuroptera, published by the Smithsonian Institution. It may be had at the Naturalist's Book Agency. The best account of our Orthoptera is to be found in Harris's Treatise on Insects Injurious to Vegetation. The Smithsonian Institution have also recently published Mr. Scudder's List of Orthoptera, which is very necessary for the student. We have observed caterpillars infesting herbaria in winter. Please send us a specimen of the Eudryas grata-like pupæ found boring into the side of the wood, so that we can determine what it is. We did not know that *Vanessa Antiopa* fed on Indian corn, or that *Œdema concinna* fed on the poplar. These caterpillars will sometimes change their food plant.

R. B., Newberne, N. C. — The spiders are *Epeira riparia* Hentz, and *E. cancer* Hentz. The eggs of the latter, enclosed in a greenish yellow cocoon, hatched out in October. The young were of the rounded form of *E. vulgaris*, differing greatly from the angular, spiny, transversely oblong form of the adult.

BOOKS RECEIVED.

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